ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 17, No. 2. WEEKLY. | NEW YORK, SATURDAY, SEPTEMBER 6, 1890. | $3 per annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

A Curious Telephone Experiment.

Some weeks ago, while Messrs. Hibbard and Pickernell, of the American Telephone and Telegraph Company, were experimenting on a line between Ithaca and Courtland, New York, the following curious action between the telephone and a long distance transmitter was noticed. Mr. Pickernell was engaged in talking on one pair of wires, while Mr. Hibbard was listening on another pair on the same pole line, 20 miles away. Both circuits were equipped with transmitters and receivers. Mr. Pickernell's voice came in on circuit No. 1 by direct transmission so as to fill the room, and, in fact, made such a noise that Mr. Hibbard was unable to listen for traces of induction on circuit No. 2. Doubtless the patrons of the long distance service will appreciate such obstreperous transmission, but in this case the receiver on circuit No. 1 must be strangled or the test could not go on. To do this Mr. Hibbard placed the offending receiver against the mouthpiece of the transmitter on the same circuit so as to close it up and prevent the escape of Mr. Pickernell's voice into the room, when, lo! a shrill and sustained musical note of high pitch was emitted which drowned all other sounds. The pitch varied occasionally through an octave, but was exceedingly uniform in volume, and did not break while the telephone was held against or near the transmitter. The explanation of this action is as follows:

The vibrations starting in the transmitter actuated the telephone through the primary and secondary circuits, the telephone throwing the impulse back to the transmitter through the air volume separating the two instruments, the transmitter reacting as before, the impulse acting with sufficient rapidity to form a musical note.

We believe this is the first recorded observation of "back talk" between a telephone and transmitter. The energy for maintaining this action is stored up in the battery, which must be in good condition. The accompanying diagram shows the simplest method of accomplishing this result.

Street Railway Facts.

The superintendent of census has issued a bulletin which presents some interesting figures about the street railways in the cities having a population of 50,000 each or over. Fifty-six cities have been included in this census. In 1880 these cities had a mileage of 1,689, while in 1889 they had 3,150. Mileage or length of line is defined to mean length of road-bed or length of street occupied. If double tracks were counted double the figures would be much higher. Hence Philadelphia appears to have more mileage than New York. The total mileage assigned to the five leading cities is: Philadelphia, 283; Boston, 200; Chicago, 184; New York, 177; Brooklyn, 164. But if we turn to the column which counts double for double tracks and gives the total miles of track, this is the way the five cities stand: New York, 368; Chicago, 365; Boston, 329; Brooklyn, 324; Philadelphia, 324. The length of double track in each of the five cities is: Chicago, 176; New York, 161; Brooklyn, 138; Boston, 104; Philadelphia, 39.

The motive power of the total mileage is distributed thus: Animal power, 2,351; electricity, 260; cable, 255; steam (elevated roads), 61; steam (surface roads), 221; total 3,150. Only three cities had elevated steam roads, namely: Brooklyn, 24 miles; Kansas City, 5; New York, 32. Steam surface roads are common, but Birmingham, Ala., is away ahead of all competitors with 60 miles. Baltimore is the biggest city that has nothing but horse power. Chicago is all horse power with the exception of 24, and Philadelphia with the exception of 23 miles of cable. Scranton, Pa., is the only town in the list that has nothing but electricity. Boston, however, has four electric lines, with 49 miles for Scranton's 23. San Francisco leads in cable lines, with 47 miles.

Gauss' Work on the Telegraph.

"I don't remember," writes Gauss to Olbers, on the 20th of November of the year 1833, "my having made any previous mention to you of an astonishing piece of mechanism that we have devised. It consists of a galvanic circuit conducted through wires stretched through the air over the houses up to the steeple of St. John and down again, and connecting the observatory with the physical laboratory, which is under the direction of Weber. The entire length

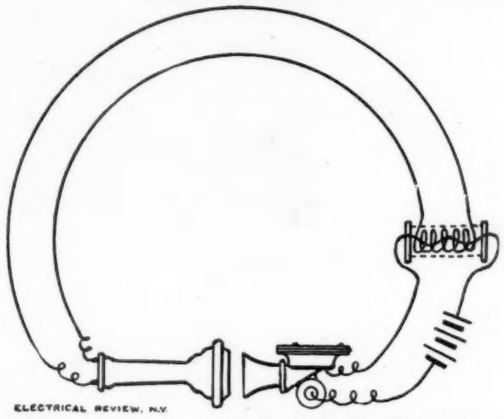

Diagram Illustrating the Hibbard Musical Telephone.

of the wire may be computed at about 8,000 feet. Both ends of the wire are connected with a multiplicator, the one at my end consisting of 170, and that in Weber's laboratory of 50 coils of wire each wound around a one-pound magnet suspended according to a method which I have devised. By a simple contrivance—which I have named a commutator—I can reverse the current instantaneously. Carefully operating my voltaic pile, I can cause so violent a motion of the needle in the laboratory to take place that it strikes a bell, the sound of which is audible in the adjoining room. This serves merely as an amusement. Our aim is to display the movements with the utmost accuracy. We have already made use of this apparatus for telegraphic experiments, which have resulted successfully in the transmission of entire words and small phrases. This method of telegraphing has the advantage of being quite independent of either daytime or weather; the one who gives the signal and the one who receives it remain in their rooms with, if they desire it, the shutters drawn. The employment of sufficiently stout wires, I feel convinced, would enable us to telegraph, with but a single tap, from Göttingen to Hanover, or from Hanover to Bremen."

Electric Wires to be Considered by an Expert Board.

Provision has been made for the appointment, by the President, of a board consisting of three persons—one army engineer, one civil engineer and one expert electrician of high repute—to consider all matters pertaining to electric wires in the District of Columbia and report not later than December 1, 1891, as follows:

First. Recommendations for a complete system of conduits or subways, with all suitable branches, connections and appurtenances for the safe and efficient operation therein of the necessary cables and conductors; such recommendations to be accompanied by maps, detailed drawings and estimates of cost.

Second. Opinion as to whether the conduits or subways should be built, owned and operated by private corporations or individuals, subject to public control, or constructed and maintained by public authority, and leased to companies or individuals. If the latter, recommendation will be made as to the terms and conditions upon which such leases should be executed.

Third. Also recommendations concerning the construction, location, operation and maintenance of underground cables and conductors carrying currents of different intensities, with a view to promote the public safety, and to secure the most convenient and efficient use of such cables and conductors, and the appliances connected therewith.

Fourth. Recommendations as to the restrictions, if any, which should be imposed by law upon the character and intensity of electric currents conveyed by conductors situated over or under the public streets, avenues and spaces, and used for electric lighting, transmission of power, telegraphy, telephony or signaling.

Fifth. Recommendations respecting the regulation of the arrangement and use of authorized overhead wires.

The White Squadron.

"The old sailing frigate and the great line of battle ships, with towering masts and enormous squares of canvas, their long rows of guns, tier upon tier, their crews of several hundred men, have disappeared in the mists of the past along with the heroes of Cooper and Marryat. The smallest vessel of our squadron, with her six guns, her powerful engines, and all the appliances of defence and offence that steam and electricity, in short, that modern science contributes to the safety and efficiency of a ship and a ship's company of the present time, would destroy a whole fleet of 'saucy Arethusas.'"
—*R. F. Zogbaum in September Scribner.*

The Latest Figures.

Whipple's Electric Reports for August furnish the following information in regard to central electric light stations:

Stations in United States	1,474
" " Canada	101
" " Cuba	1
" " Mexico	9
Total Stations	1,585

These are the figures for the gas companies:

Companies in United States	966
" " Canada	49
" " Mexico	1
Total	1,016
Companies operating electric lights, U. S.	274
" " " " Canada	20
" " " " Mexico	1
Total	295

The street railway companies:

Companies in United States	854
" " Canada	21
Total	875
Electric roads in operation and under contract in United States	223
Electric roads in operation and under contract in Canada	4
Total	227
Cable roads in United States	44

PERSONAL.

Mr. George Westinghouse, Jr., of Pittsburgh, spent a few days last week in New York, stopping at the Windsor Hotel.

Mr. W. A. Kreidler, editor of the *Western Electrician*, was a New York visitor last week, called East by the Cape May Convention.

Gen. E. S. Greeley, of The E. S. Greeley & Co., has been spending a short vacation in the Adirondacks, returning home last week.

Mr. George W. Davenport, who is the responsible head of the Thomson-Houston International Company, Boston, spent a few busy days in New York last week.

Mr. Hy. S. Thornberry, electrical engineer of Toronto, Canada, spent last week in New York, with headquarters at the Electric Club. Mr. Thornberry is a capable electrician and inventor, well known in telephone and electric light circles of Boston and New York.

Mr. R. T. McDonald and Mr. M. M. M. Slattery, of the Fort Wayne Electric Company, were New York visitors last week. Mr. McDonald has just returned from San Francisco, where his electric light system has been installed in the Palace Hotel, 7,000 incandescent lamps being used. This is probably the largest number of electric lamps in one building in the world.

Prof. Alexander Graham Bell, the inventor of the telephone, has given $25,000 to the Hudson Institute of the Deaf and Dumb for the promotion of special teaching. The fund will be available as soon as the association is incorporated. The trustees appointed to perpetuate and apply the fund were Alexander Graham Bell, Caroline A. Yale, D. C. Greenberger, Mary H. True, Ellen L. Barton, Z. F. Westervelt.

California Electrical Society.

At a meeting of the California Electrical Society, on August 18th in its new rooms in the Murphy Building, San Francisco, Frank P. Medina, an operator in the Pacific Postal Telegraph Cable Company, read a paper on the galvanometer. The paper was very interesting, and in it Mr. Medina dwelt at considerable length on how the galvanometer is constructed and the use to which it is applied. Mr. Medina illustrated his lecture with diagrams on a blackboard.

The Coupling and Control of Dynamos in Central Stations.

As central station work develops, and as the demand for more nearly constant pressure on the supply circuits becomes more pressing, the necessity for considering the best ways of governing or controlling the pressures of a large number of machines comes to the front. The subject is somewhat difficult, and, as far as I know, writes Mr. James Swinburne in London *Industries*, it has not yet been dealt with systematically. This article is written with the view of bringing the matter forward, so that it may be more thoroughly ventilated than it has been so far.

DIRECT CURRENTS.—In direct current work low pressure, of 100 volts or so, is universally used, except when batteries are employed as direct transformers and in such cases as arc lighting. Series arc lighting and distribution from batteries used as transformers are outside the scope of this article. Even parallel supply from batteries and dynamos together will hardly be touched, as the pressure in the supply circuits then depends on the batteries, and is regulated by cutting cells in or out, and is not controlled by the dynamos, engines or their regulating gear or governors. The three, four or five wire arrangements are practically multiples of a single parallel system and do not need special attention.

Direct current station dynamos are always shunt wound or separately excited. By separately excited it is not here meant that they have special exciters, but that the supply is taken from the mains. In this sense a dynamo running in parallel with a number of other machines may be regarded indifferently as shunt wound or separately excited; and, as a matter of fact, the field magnet circuit is always made before the armature circuit, to ensure that the machine starts in the right direction. A number of shunt machines may be coupled together and regulated in various ways. The engines may have speed governors, or may be controlled by hand valves, or even by electrical governors whose action depends on the pressure of the whole station, or on it jointly with the current given by the dynamo it drives. In fact the governor may be compound wound. In some cases each engine drives several dynamos, in others only one machine. Then the dynamos may have adjustable resistances in their field circuits which are independently controlled by hand, so that one field is altered at a time; or the whole of the field magnet circuits may be arranged to be controlled together. Sometimes they are so arranged that each dynamo can be regulated by itself, and the whole of them can also be weakened or strengthened together as the load on the station falls or increases.

Take first the case in which each engine has a speed governor. Governors for engines are in the market in endless variety, and though great trouble and ingenuity have been spent, it is questionable whether mechanical governors have been studied from quite the right point of view. In the first place, an engineer in designing a governor is far to apt to consider it by itself without taking the engine into account at all. This gives rise to several troubles. Many governors have been designed so as to be sensitive, and perhaps to be nearly isochronous when disconnected, but are then rendered quite useless by hanging on a heavy expansion link, or by setting the governor to work a stiff throttle valve or other gear. This is the commonest mistake of all in governor design. There is another more complicated question, which is of vital importance, and, so far as I know, has been little studied, and that is the question of "hunting." A discussion of the theory of government of engines, to be at all satisfactory, would need several articles to be devoted specially to it, and it may be as well to deal with the question separately; but in the meantime the theory of "hunting" may be lightly touched.

Suppose an engine has a governor which, so far from being burdened with expansion links or gear, controls the trip gear of an engine on the Corliss principle, or works by means of some relay arrangement, so that it really controls the engine. Suppose, instead of being perfectly isochronous, it is set to allow the engine to go five per cent. faster at no load. This governor may be arranged to respond to a variation of speed almost instantly, or it may have considerable inertia, or be provided with a dash-pot to make it respond slowly. Suppose, for example, that it responds fairly quickly. The engine has also a rate of response relatively to the governor. If the engine has a heavy fly wheel, and if it runs slowly, so that a cylinder full of steam represents a large installment of energy, it will respond slowly to the governor, especially if the load is light. If, for instance, half the full load is taken off suddenly, the speed of the engine gradually increases, and the governor then commences to cut off the steam. The engine goes on increasing in speed as long as it gets more than half steam. We may suppose, for example, that the full load speed of the engine is 100 revolutions per minute, and the no load speed 105. At half load, the equilibrium speed should be 102.5. But as the governor does not respond instantly to the change of speed, by the time the governor has cut the steam down to half, the engine has quickened up to, say, 110 revolutions. The engine begins to slow down from that instant; but as the speed is above the governor's normal speed for half steam, the governor goes on reducing the steam. By the time the engine is down to 102.5 revolutions the governor has cut off far too much steam. It begins to increase the steam again, but the engine goes on slowing down till the governor gives it half steam. The engine then begins to quicken, but when it has got to 102.5 the governor has overshot its mark, and is giving too much steam. The engine then races again, and this cycle of things is repeated. It depends on the speeds of response of the governor and engine whether the hunting increases till the governor gives from no steam to full steam, in waves; or tapers off to a state of equilibrium—that is to say, of regular running. The speed of response of the engine varies with the load. An engine with a heavy fly wheel and a light load will often hunt, and will run steadily when the load is put on. The hunting can be avoided by making the engine respond quicker, or the governor slower, or much quicker. The more nearly isochronous the governor is, the more tendency there is to hunting. If the governor is made fairly isochronous, and is arranged to respond very quickly in comparison with the engine, the hunting can be avoided, but the working is curious. As an extreme case, suppose an isochronous governor, which acts instantaneously on a slow-speed engine with a heavy fly wheel. Whenever the engine goes too fast the steam is cut off altogether, and as soon as it gets below speed again it gets full steam. This is really a sort of hit-and-miss arrangement, such as we are accustomed to in some gas engines. There seems no reason why such a system should not work economically. The cut-off would be set so that the engine would give its best efficiency at full load; then at light loads, instead of working with a bad diagram, the engine would only take an occasional cylinder full of steam, and would expand that in the best way. I believe this system of governing is not used. If the governor is not to act on the prompt, or hit-and-miss, principle, it must respond more slowly relatively to the quickness of response of the engine; to avoid hunting it must then be made anisochronous, and it must respond very slowly. If it responds very slowly, the engine may race on load being removed, or may slow down excessively on load being put on, the governor taking a long time to get to the proper position. This is, of course, very bad. Instead of making the governor respond slowly, the engine may be made to respond quickly. It is strange that there is a very common idea that if an engine is to run uniformly it should have a very heavy fly wheel, and should run slowly. The fly wheel secures evenness from stroke to stroke of the piston, but it makes it difficult to govern as to average speed, for it makes the engine respond more slowly. Probably most of the difficulties in governing mill engines, arise from the use of slow engines with big fly wheels; and the more difficulties engineers find, the more inertia they give their engines. On the other hand, a small high-speed engine is more easily governed. Even an engine like Willans', with a Willans governor, will hunt on light loads, unless the vibration period of the governor is made larger. I have tried the same governor on a slower fly-wheel engine, and it was impossible to govern under one-third load. More recently I have made an electric relay governor to control an engine with an absurdly large inertia in proportion to its load, so that it responded to the governor very slowly. In this case the promptness of the governor could be reduced to any degree of slowness, and to get the whole into stable equilibrium the governor had to be made so slow that the period of the whole system was about 50 seconds. Even then, after a sudden change of load, there was considerable hunting before the engine remained at its correct speed. In the case of electric lighting from stations, the tendency to hunt is often checked. In the first place, several engines and dynamos work in parallel, so that, unless they all hunt together, the proportion of load taken by each varies enormously with small changes of speed, and checks the tendency to hunt. Secondary batteries have also a similar effect. In the examples it was assumed that the load was independent of the variations in speed; strictly speaking, this is, of course, not the case. The variation of load with the speed, of course, also tends to check hunting—that is to say, it makes the engine respond to the governor quicker. The question of hunting is, therefore, not so important in direct current work, where many engines and machines are coupled together, as in alternating work, where one engine and one dynamo work one circuit. It is also important where one large engine drives many direct current dynamos not coupled to those driven by other engines. It is, therefore, worth while to go into the matter to some extent now, so as to avoid the necessity of returning to the subject of engine governors when I come to alternating current work.

FIG. 1.—VIEW OF THE ELECTRIC RAILWAY OF THE PITTSBURGH TRACTION COMPANY—SHORT SYSTEM.

So far the governors have been supposed to be mechanical speed governors; electrical governors, of course, follow much the same laws. Dismissing all questions of hunting, the electrical government of a number of engines and dynamos, or, as they may be called for shortness, steam dynamos, is very complicated. Take first the cases of a governor on each engine. If each is simply a pressure governor it is controlled only by the station pressure, and the movement of the governor is not specially dependent on the doings of the particular dynamo it controls. The least inaccuracy in adjustment allows one dynamo to do more work than another. The governors only keep the pressure right as a whole, they do not know what share each dynamo gives. At first sight it would seem that an additional wire on each governor coil in series with the dynamo controlled by it would work, so that as soon as a dynamo gave more than its share of current its governor would shut off steam more than the others. This would, however, give a lower pressure throughout the station as the total load increases, for, with the same pressure, the ampere turns on each of

the governors would increase with the load. The ampere turns on the governor should remain constant, or, if anything, decrease, so that the station, as a whole, "compounds up" a little to compensate for losses in leads and feeders. To secure this, some demagnetizing current turns must be added to each governor, which are in series with or proportional to the current of the whole station. By making these slightly excessive, "compounding up" of the whole station is secured. A new difficulty crops up, however. The demagnetizing turns can only be permanently correctly proportioned if the number of steam dynamos in use is constant, so that each always does the same share of whatever the output of the station may be. To avoid this difficulty means adding more complications to a system which is already almost too complicated to be of any practical value.

Instead of putting an electrical pressure governor on each engine, one may be put on the whole steam supply, or may be arranged to control all the engines by altering the ratios of expansion or otherwise. This arrangement has many advantages. An accurate governor that can be thoroughly depended upon is necessarily costly. It is much better, then, to put all the work into one thoroughly good piece of apparatus. Each engine can then have a speed governor set for 20 per cent. or so over normal speed, so as to prevent accident in case of a fuse going, or field circuit being opened from any cause. At light loads, if all the engines are on, of course the diagrams are bad, but an attendant shuts off steam from some, and stops them so that those running have fair loads. The stop valves are always full open or closed, the speed depending entirely on the main throttle valve. Instead of a main throttle valve, which is not always possible, owing to multiplicity of boilers, the expansion gear or cut-off, or throttle on each engine, may be controlled by the main governor. The action is radically different from that of an electric governor on each engine, for all the cut-offs or throttles are worked simultaneously and equally, so that there is no possible inequality of load among the dynamos.

Good Railway Work in the West.

The Chicago, Milwaukee and St. Paul Railroad have kept pace with the many improvements in train lighting, and to-day are running the best electrically equipped trains West and North from Chicago.

Besides running a complete electric lighting plant on each through vestibuled limited train, which has been fully described in recent numbers of the REVIEW, the company have carefully studied the arrangements of lights throughout the day coaches and sleepers so as to obtain the best possible results, and incandescent lights, with all their brilliancy and superiority over the old coal oil lamp formerly used, have been found too dim when located in the aisles, suspended from the car ceiling; to overcome this, and give the traveler the best light obtainable, the above company have placed in each berth what they call a "*berth light.*" This light, or rather one incandescent lamp is placed inside a silver-plated drum, which in turn is set in the partition separating two berths; this drum is provided with a lid or a slide, so that an occupant of one berth may close the drum on his side without depriving the other of the light, or *vice versa*. In this way, a traveler may recline on the soft cushions, or lie in the berth, and peruse his paper or book, while the reading is made easy by the brilliant light thrown as above described.

The steps in this direction, taken by this company, should be appreciated by all electricians who find it necessary to travel.

These electrically equipped vestibuled trains leave Chicago on the Northern Division of the road each day at 5.30 P. M., arriving at St. Paul the next morning at 7 and at Minneapolis at 7.40; returning leave Minneapolis at 7.20, St. Paul at 8 P. M., arriving in Chicago the following morning at 9.30 A. M.

The Short Electric Railway Company expect to have a large exhibit of their electric railway appliances at the meeting of the Street Railway Convention to be held in Buffalo October 15th.

The Short Electric Railway Company's Line at Pittsburgh, Pa.

Cuts that we publish this week showing the Short Electric Railway Company's cars, which have been in successful operation since the 4th of July upon the Oakland Branch of the Pittsburgh Traction Company's Line, illustrate very well what can be done with electric motor cars on a very hilly road. The line is almost two miles in length, and has some of the most difficult grades and curves which exist on any road in the United States. There are some six or eight right angle curves of from 30 to 45 feet radius, and one curve of 120 degrees with only 30 feet radius. There is scarcely a level piece of track on the whole road, and the grades vary from 2 per cent. to 7 per cent. There is one 65 horse-power generator at the station, driven by a Ball engine of 100 horse-power capacity, and one of the standard switchboards commonly used by the Short Electric Railway Company. The dynamo and engine are placed in the power station of the Cable Railway Company, on Fifth avenue, the engine receiving its steam from the same boilers as the cable engines. The attention required to operate the electrical station is by this arrangement reduced to a minimum, and the only extra expense to which the company is put for operating this road is for one engineer during the day and at night to look after the engine and oil the bearings of the machines. Although the Ball engine and the Short generator were both entirely new when they first started on the 4th of July, they have never had to be stopped for any cause during the hours of travel since the road started. The motors have done their work equally well. Each car is provided with a standard Bemis truck and two 15 horse-power standard motors of the Short type. The remarkable thing which strikes one upon watching these cars run, is the absence of the noise common to the ordinary electric motor. This noiselessness is due to the fact that these cars are equipped with the insulated wooden web gears, patents for which are owned and controlled by the Short Electric Railway Company. Each car makes a round trip on this road every 15 minutes, and often reach their destination ahead of their scheduled time. The cars present an elegant appearance, and the ease with which they ride is remarkable. Each car carries from 500 to 800 people every day, showing that the public thoroughly appreciate rapid transit. The line construction is very neat, octagonal wooden poles being used. These poles are well painted, and a single wire only is stretched over each track throughout the entire extent of the line. Much of the street is nicely paved with block stone, and altogether the road is one of the most successful now in operation, both from a mechanical and financial point of view.

FIG. 2.—ANOTHER VIEW OF THE SAME ROAD.

The Association of Edison Illuminating Companies.

The annual convention of the Association of Edison Illuminating Companies for the year 1890 will be held at the West Hotel, Minneapolis, Minn., commencing on Tuesday, September 16th.

There are many circumstances which combine to render this session one of extraordinary interest and importance. Among these may be noted the fact that as a year has elapsed since the last convention, many events of vital consequence have occurred, and the general progress of the Edison business will not only bring many new and interesting phases of electric light work before the convention, but will point many practical lessons to the active executive members of the various illuminating companies composing the association.

It is important to note that the managers of the principal stations of the country are expressing an unusual interest, that the officials of the parent company are making preparations to attend, and that the presence of Mr. Edison is assured.

The following are among the subjects which will be discussed at this session:

Lightning protection—results of experiments.
Insurance of Edison central stations.
A national code of insurance rules.
Edison patent litigation.
Central station steam piping.
Re-organization of Edison interests.
Grounding the neutral wire in three-wire systems.

Mr. W. J. Jenks, the secretary, 44 Wall street, New York, is arranging for a special car to leave New York city at 9.50 A. M., Sunday, September 14. All who intend to go from here should communicate with Mr. Jenks at once.

Stroudsberg, Pa.—Penn City Electric Company; capital $2,000.

Owosso, Mich.—Owosso City Electric Railway Company; capital, $50,000.

Wellsville, O.—Valley Electric Light and Power Company; capital, $25,000.

Beatrice, Neb.—Beatrice Rapid Transit and Power Company; capital, $150,000.

Quanah, Tex.—Quanah Water, Ice and Electric Light Company; capital $75,000.

Washington, Pa.—Washington Electric Street Railway Company; capital, $60,000.

Palmyra, Mo.—Palmyra Electric Light and Water Works Company; capital, $50,000.

Mt Pleasant, Mich.—The Edison Electric Light and Power Company; capital, $10,000.

Momence, Ill.—The Momence Electric Light Company; capital $3,000; incorporators, I. C. Riker and L. W. Calkins.

Boston, Mass.—The New England Printing Telegraph Company; capital, $15,000. President, F. B. Dole; treasurer, R. H. Waters.

Birmingham, Ala.—Consolidated Electric Light Company; capital, $500,000. Incorporators, J. F. B. Jackson, R. M. Mulford and Robert Jemison.

San Francisco, Cal.—The Sunderland Pacific Coast Telephone Company, capital $100,000. The directors are Frank A. Fox, T. H. Goodman, William B. Hooper, J. A. Fillmore and George W. Hupers.

Napa, Cal.—Napa Thomson-Houston Electric Light Company; capital, $50,000. Directors, Chas. P. Eells of Alameda, and Thomas Addison, Samuel H. Taylor, Max Caspari and Wm. H. Waite, of San Francisco.

Philadelphia, Pa.—Suburban Electric Company; to furnish heat, light and power by electricity. The capital is $200,000, and the directors: T. W. South, H. A. Mullin, J. S. Disston, P. E. Costello and Hamilton Disston.

ELECTRICAL REVIEW

Published at 13 Park Row

P. O. BOX 3329.

GEO. WORTHINGTON, - - Editor.
CHARLES W. PRICE, - Associate Editor.
ROBT. H. READ, Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.

"1846 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
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One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, SEPT. 6, 1890.

CONTENTS.

	PAGE.
A Curious Telephone Experiment	15
Street Railway Facts	15
Gauss' Work on the Telegraph	15
Electric Wires to be Considered by an Expert Board	15
The White Squadron	15
The Latest Figures	15
Personal	15
California Electrical Society	15
The Coupling and Control of Dynamos in Central Stations	16
Good Railway Work in the West	17
The Short Electric Railway Company's Line at Pittsburgh, Pa	17
The Association of Edison Illuminating Companies	17
New Corporations	17
John Bull's Jealousy	18
United States Senators Attack the Telephone	18
Book Reviews	18
Correspondence:	
Our Washington Letter	18
In New England	18
Our Chicago Letter	19
Our Philadelphia Letter,	19
Our Boston Letter	19
Convention Notes	19
Jest for Fun	19
Telephonic News	20
A Chinese Telephone	20
Some Important Electrical Patents	20
Another Postal Telegraph Bill	20
The Anvil Chorus	20
Air as a Conductor of Electricity	21
Contracts Made by Mail or Telegraph	21
Byrnes and the Telegraph	21
Telegraphic	21
What General Bangs Overheard on the Wire	21
Electric Power	22
Reed's Lake Electric Railway	22
Counted by Electricity	22
On Units of Light and Brightness	23
New Work of the Westinghouse Company	23
Electric Shock	23
The Dynamo as a Motor	23
Electric Light News	23
Electrical Execution	24
Deaths from Illuminating Gas	24
The Electric Light Car of the Pennsylvania Railroad Company	24
Underground Work in Washington	24
An Interesting Column:	
Accustomed to It	24
A Popular Rendezvous	24
Retirement of the Gray Mule	24
Fixtures Damaged	24
You Touch the Base, Electricity does the Rest	24
An Important New Construction Company	24
Electrical Indicator of Explosive Gases	24
Kindred Interests	iii
Electrical Patents	iii

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Ansonia Brass & Copper Co	4
Armington & Sims	4
Bridgeport Brass Co.	4
Brush Electric Co	3
Davis, Charles H., Electrical Engineer	4
Day's Kerite Insulated Wires	4
Eastern Electric Cable Co.	4
Hampson & Co., E. P.	4
Jewell Belting Co.	4
Moore, Alfred F.	4
Okonite Co	4
Sawyer-Man Electric Co.	2
Simplex Electrical Co.	4
Standard Underground Cable Co	4
Tucker Electrical Construction Co.	4
Wilmot & Hobbs Manufacturing Co., The	4

INSIDE PAGES.

American Bell Telephone Co	xi
American Circular Loom Co	v
American Electrical Works	iv
Baker & Co	iv
Ball Electric Light Co	xi
Baxter, H. E. & C	xi
Boston Rubber Shoe Co	iv & xvii
Brownlee & Co	xvii
Bryant Electric Co	xvii
Buckeye Engine Co	ix
Burton Electric Co	xi
Cary & Moen	xvi
"C. & C." Electric Motor Co	vii
Central Electric Co	xiii
Chadbourne, Hazelton & Co	x
Clark Electric Co	iv
Columbia National Bank	iii
Connecticut Motor Co	x
Crocker-Wheeler Motor Co	xv
Dwight Slate Machine Co	xvi
Eddy Electric Manufacturing Co	xvii
Edison General Electric Co	xi & xviii
Edison Manufacturing Co	xii
Electric Merchandise Co	xiv
Elektron Manufacturing Co	v
Empire China Works	xi
Empire City Electric Co	xx
Eugene F. Phillips Electrical Works, Ltd	iv
Evans Friction Cone Co	v
Eureka Tempered Copper Co	ix
Faraday Carbon Co.	xvi
Fort Wayne Electric Co	xx
Freeman, Walter K	xvi
Garvin Machine Co	ix
Gibson Gas Fixture Works	vii
Gordon & Co., W. H	iv
Great Western Electric Supply Co	xix
Greeley & Co., The E. S	iv & xv
Hazazer & Stanley	xv
Heine Safety Boiler Co	ix
Holmes, Booth & Haydens	v
Holtzer Cabot Electric Co	xi
Horn, Brannen & Forsythe Manufacturing Co.	x
Illinois Electric Material Co	xvii
Interior Conduit & Insulation Co	xiii
Lane & Bodley Co	xvi
Leclanche Battery Co	iv
Leffel & Co., James	xvi
Lehigh Valley Creosoting Co	iv
Macfarlane & Co., Wm	iv
Maguire, F. Z	iii
Manufacturer	iii
Marshall, Wm	xv
Messner, C. W	iii
National Carbon Co	xi
National Electric Mfg. Co	xii
Newark Machine Tool Works	iv
New England Butt Co	ix
New York Belting and Packing Co	xvi
Noye Mfg. Co., John T	ix
Ostrander & Co., W. R	iv
Page Belting Co	xv
Paillard Non-Magnetic Watch Co	xv
Palermo Mica Co	xv
Parker-Russell Mining and Manufacturing Co.	xvi
Phoenix Glass Co	iv
Phosphor-Bronze Smelting Co., Ltd	x
Pond Engineering Co.	ix
Queen & Co., James W	iv
River and Rail Electric Light Co	xiv
Roebling's Sons Co., John A	xv
Royce & Marean	xvi
Santley & Co., W. R	xv
Schuyler Electric Co	xvi
Seely & Taylor Manufacturing Co	xiv
Southern Electrical Supply Co	v
St. Louis Electrical Supply Co	xv
Stevens & Babcock	xv
Thomson-Houston Electric Co	vi
Trinidad-Heimann Insulated Wire Co	xi
Tropical American Telephone Co.	vii
United Electric Traction Co	xiii
Vincent & Co., Charles R	ix
Wainwright Mfg. Co	xx
Walker Electric Co	ix
Washburn & Moen Manufacturing Co	xvi
Washington Loan & Trust Co	iii
Washington Electric Conduit Co	iii
Watson & Stillman	iv
Western Electric Co	xvi
Western Power Construction Co	vii
Westinghouse Electric Co	viii
Williams & Potter	ix
Wyckoff Pipe Co	iv

A comic paper says that the cost of running an electric railway may properly be charged to current expenses.

In another column we give some interesting information regarding the street railways of this country. These figures are a product of the recent census.

JOHN BULL'S JEALOUSY.

John Bull is green with envy over the rapid strides taken by American inventors in the field of invention. The English journals at every issue contain some slur intended to detract from the value of the great inventions in power, lighting, telegraphy, or the multiplicity of applications found for the subtle fluid by the ingenious American. It is, doubtless, very hard for our English cousins to admit that they are beaten in the contest of brains, but they can scarcely fail to realize the situation, and it would be more creditable to bow gracefully to the inevitable. Just now they are directing their slings at the phonograph, and assailing its commercial usefulness. It has not taken the public on this side of the pond long to learn how to employ this marvelous instrument. The thousands of instruments in active use by business men in the dispatch of their daily routine, is a safer criterion of the commercial value of the invention than the slurs of quasi-scientific scribblers, who, if they labored until the crack of doom, could give birth to nothing more useful than a few tomes of platitudinous twaddle.

UNITED STATES SENATORS ATTACK THE TELEPHONE.

Another serious and unreasonable attack has been made on the telephone company, at Washington, by Congress. Upon the strength of statements made by Senator Morgan, of Alabama, the Senate has passed an amendment to an appropriation bill stipulating that the rate charged the government for exchange service shall not exceed $30 per annum, and that, if the company refuses to accept this rate, it shall be prohibited from running its lines in any government building or grounds, or along any street bordering on them. In his argument favoring this legislation, Senator Morgan talked like an ignorant demagogue, declaring that the Patent Office had granted the "giant telephone monopoly a franchise to commit robbery.'

The only reason given by the Senator for reducing the price charged for telephonic service is the absurd one which has been continually presented and exploded ever since the business was started—that the telephones themselves cost only a few dollars, and that customers should pay nothing more than a fair profit on this cost, leaving entirely out of sight the expense of maintaining the lines and performing the service, which continually increases with the growth of the business.

The fact that these distinguished government officials so frequently make such blunders, suggests the propriety of their having the assistance of some such person as the talented and eccentric Count Gurowski who, when asked what work he had to do in the State Department, replied that "his principal duty was to keep Secretary Seward from making a fool of himself."

BOOK REVIEWS.

"Bulletin of the American Chemical Society," containing a report of the first general meeting held at Newport, R. I., August 6 and 7, has been received.

"Bulletin de la Société Internationale des Électriciens," for July, has been received. This issue contains, among other interesting articles, a paper on American electric railways, by Mr. Abdank-Abakanowicz.

"Transactions of the American Institute of Electrical Engineers," for June and July, 1890, appear in a double number containing the papers read at the general meeting, held on May 21st. All these papers were printed in full in the ELECTRICAL REVIEW.

"Rules and Requirements of the Pacific Insurance Union for the Installation of Electric Light and Power," has been received from Mr. Geo. P. Low, of San Francisco, one of the electrical inspectors for the company. The rules are up to date, and the pamphlet, which is of a convenient pocket size, contains tables which will be useful to the lineman.

"A Successful Man" is the title of what is probably the brightest American story—typically American—which has appeared for many years. It is a story of life prominent in fashion and in politics, written by a member of New York's highest society, who displays a genius as a writer destined to make her name famous—although she substitutes a *nom de plume* for her own well known one. The story will appear in two parts in the *Cosmopolitan Magazine*—the first in the September issue—and is illustrated by Harry McVickar, the drawings being made from life from acting models who were guests and servants at a Long Island country house.

Surely some mischief is brewing. The primary battery fiend has not been heard from in months. That he is getting in his smooth silken work somewhere and producing a "blaze of light from a lot of old cups"—as we once heard it eloquently described—to the astonishment and delight of the speculative uninitiated is absolutely certain. It worries us that we cannot keep him in sight.

CORRESPONDENCE.

Electrical News from Electrical Centers.

OUR WASHINGTON LETTER.

Work on the Judson Pneumatic Railroad is being vigorously prosecuted, and the managers expect to have it running in the course of two months. The power station will be equipped with two Babcock & Wilcox boilers, one 500 horse-power compound Corliss engine made by Cooper & Co., Mt. Vernon, Ohio, and Ingersoll air compressors. The air will be conveyed, under 80 pounds pressure, through six inch cast iron pipes to the engines, where it will be heated to 400° Fahrenheit, before being used. Four engines, 40 horse power each, built by B. W. Payne & Sons, Elmira, N. Y., are set in brick compartments, about 16 feet square and 6 feet deep, under the track, 1,500 feet apart. These engines are to be run at a speed of 250 revolutions, and will be connected to the main shaft by 12 inch belts. The engine and shaft pulleys are both 36 inches in diameter and are five feet between centers. Each engine is expected to drive an independent section of the main shaft, 1,500 feet long. The shaft is a hollow cylinder, nine inches in diameter, made in 20 feet lengths and connected by swivel joints. The track construction is almost identical with cable road construction, and is so arranged that the pneumatic apparatus can be removed and a cable substituted, should such a change be found desirable.

Electrical Engineer Mailloux, who is conducting the storage batt ry experiments for the Metropolitan Railroad, has made decided improvements in his street car, which is now running very smoothly over the entire length of the road, and doing its share in transporting passengers. Mailloux states that a careful record of the cost of operating this car has been kept, and that experience shows that it can be run somewhat cheaper than horse cars.

Woodward & Lothrop's large dry-goods store is being fitted with an independent incandescent lighting plant under the supervision of Mr. C. O Mailloux. One 100 horse-power Corliss engine, made by Frick & Co., of Waynesboro, Pa., will drive two Mather dynamos of 650 lights each and one of 300 lights capacity.

The Washington Electric Light Company, organized under the laws of West Virginia; capital, $250,000, shares, $25. Incorporators, H. J. Gray, S. S. Henkle, J. Geo. Gardner, J. H. McGowan, Wm. H. Mattingly and W. W. Rapley, proposes to establish a central station in Washington, D. C., and supply incandescent lights by the Loomis direct current system.

The Edison Lighting and Power Interests, which include the street railroad system heretofore known as the Sprague system, are represented here by Mr. Geo. W. Silsby, who has so long been in the active service of the Edison Company, and who has opened an office in room No. 58, Atlantic Building. He has control of the business in Maryland, Virginia and the District of Columbia.

The Perret Motors are coming into quite extensive use, and are doing good work. The agents, Burket & Co., are now putting up two of six horse-power each, one to run seven small printing presses, and the other to run a Whittier elevator in a six-story building. G. C. M.

Washington, D. C., August 30.

IN NEW ENGLAND.

The New Britain Electric Light Company's station is undoubtedly one of the best equipped and among the most prosperous local electric light enterprises in the country. Mr. L. C. Whitney, the manager and electrician of the company, has been remarkably successful in promoting electricity as an illuminant in New Britain, not only for city lighting, but also for commercial purposes and among the residents; 150 arc lights and 1,600 incandescents are now in use, which will be increased early in the Autumn. The dynamo room equipment of the station comprises the following: Five Schuyler arc machines, three of 35 lights capacity and two of 50 lights capacity; four Edison incandescent dynamos, each of 450 lights capacity; two Ide engines, one of 100 horse-power and the other 125 horse-power; one New York safety engine of 50 horse-power, and one Fitchburg engine of 50 horse-power. The equipment of the boiler room consists of the following: One Hazelton "porcupine" boiler, 215 horse-power; one H. B. Beach & Son boiler, 125 horse-power (set with Jarvis patent furnace); one Wainwright feed-water heater of 300 horse-power; one Knowles steam pump and one damper regulator from Locke Bros., of Salem, Mass. The boiler room is so arranged that 150 tons of coal may be cared for at one time, and the coal bins being beneath the roadway, the coal is easily removed from the carts. The arc light circuit for lighting the streets is eight miles in length, and these lights are suspended from 50 "Brady" mast arms and 36 poles, respectively.

PLANTSVILE, CONN.

The Factory and Offices of the Connecticut Motor Company are located at this pretty village, amidst one of the most charming and picturesque sections in central Connecticut. The factory buildings are on the line of the Northampton branch of the New York, New Haven and Hartford Railroad, about one-fourth mile north of Plantsville. The main building is 100x40 feet, and is used for general machine work and assembling. Polishing shop is 30x30 feet, used for grinding and polishing purposes. Generating and testing rooms adjoining the engine room occupy a separate building, each being 25x 15 feet dimensions, and equipped with everything requisite for thoroughly experimenting and testing every machine before it is shipped from the factory. The present manufacturing facilities being overtaxed, the company is negotiating for the large brick building adjoining the property it now occupies, and expect to have the new quarters fitted up with machinery and an additional force of men at work about the beginning of November. The company manufactures one of the best stationary motors now in the market. It is made in various sizes, from one-half to 25 horse-power. Generators of any size are also made to order. The resistance box used by this company on its motors is a cast-iron box with slate top, the object being to render it entirely non-combustible. On every motor is placed a self-oiling journal box in which shaft runs through a reservoir containing oil, and having a loose ring on the shaft which carries the oil up to bearing as required. This arrangement, although not new, reduces the cares of the attendant to a minimum. The officers of the Connecticut Motor Company are, R. E. Dunston, president; S. Blakeslee, Jr., treasurer; and J. R. Stagg, secretary.

BRISTOL, CONN.

The Sessions Foundry Company, of the above-named town, make iron castings for electrical purposes. Dynamo and motor magnets are cast of a special mixture of iron that is said to give much better electrical results than ordinary castings. This company is enjoying a very large and rapidly increasing patronage from manufacturers of dynamos and electric motors.

The Bristol Electric Light Company is rapidly pushing toward completion its new brick station. The lighting capacity of the present station is 65 arc lights and 400 incandescents, both of the Thomson-Houston system. The engine used is a New York safety of 50 horse-power, which, together with a Bigelow boiler of 60 horse-power, constitutes the present power equipment. The new station when finished will have three times additional power and lighting capacity now afforded. The new equipment will include a Thomson-Houston 650-light alternating machine, several Thomson-Houston power generators, a Hazelton "porcupine" boiler of 200 horse power (already in position) and a Harris-Corliss engine of 200 horse-power. The new station will probably be in shape for business early in September. W. I. B.

OUR CHICAGO LETTER.

The Great Western Electric Supply Company have recently received a large invoice of telegraph supplies, and report a large sale of same, more particularly the learners' outfits. Large invoices of the same class of goods are on the road, and the company expect a large sale of these goods throughout the West. The new catalogue of this company is in the hands of the printer and is expected to be out within a week. The catalogue is a very complete one. This, which is only a forerunner of other catalogues the company contemplate, will be called their "sketch catalogue."

Incandescent Lights were put to novel use at Evanston, Ill., on the evening of August 20, at which time the business men held their picnic and parade. All the wagons were decorated indicative of the business of the owner.

J. H. Munson & Company, electrical supply dealers, had a large wagon trimmed with incandescent electric lights, which not only covered the wagon but were displayed on the horses as well. Current for the lamps was furnished by 27 Pumpelly storage battery cells carried in the wagon. The affair was unique and presented a novel and pleasing sight. The business men of Evanston seem to appreciate the many advantages of electric lights. This is plainly shown by the fact that 3,000 lights are now being supplied from the central station which was built only six months ago.

W. A. Furber, 618 Stock Exchange Building, is erecting extensive flats on the South side which will lighted throughout with electric lights.

The Domestic Sewing Machine Company awarded the United States Elcctric Company the contract for lighting their new building in Chicago.

Through the Kind Invitation of Mr. Patton, of the Patton Motor Company, your correspondent took a trip to Pullman, Ill., at which place the above company is manufacturing its motors. On arriving at Pullman, the party, consisting of Mr. Patton, Mr. Wm. Hood, Mr. H. N. Weidner, of the Electro-Dynamic Company, of Philadelphia, Pa., and the writer, repaired to the yards of the Pullman Car Company where a Patton motor car was side tracked. A trip was made over the line, which is full of curves, it being built for severe tests. The car is controlled from the front platform in about the same manner as other systems and responds quickly to the touch of the driver, running in either direction, starting and stopping without apparent exertion. After the ride, a tour of the immense shops of the world renowned Pullman Company was made, and much of interest to the party was found in all departments, especially the street car department, where a large number of cars were being equipped with electric motors of different well known types. A good opportunity was given to examine the different motors, as a passageway was found under the cars in course of construction. The party returned to Chicago in the afternoon feeling well paid for their interesting and pleasant trip.

Personal.—W. B. Knight, the well-known civil engineer, of Kansas City, Mo., was a recent visitor in the smoky city. Mr. Knight has been appointed general manager of the Patton Motor Company.—Mr. H. N. Weidner, of the Electro-Dynamic Company, of Philadelphia, Pa., stopped in the city a few days this week, while en route to Dubuque, Iowa, where his company have recently equipped a street railway.

The Chicago Edison Company met with a rather serious accident on Thursday morning last, in the breaking down of two large engines used in driving a number of Edison dynamos causing a partial suspension of business for a short time. The cause of the accident was the blowing out of the cylinder head, and the released piston rod flying through the air at a terrific rate, disabled another engine near by. In a short time the damage was repaired and the supplying of current for light and power resumed.

The Prismatic Fountain erected in Lincoln Park recently, which was a gift to the city from Mr. Yorke, president of the cable road, was started on Thursday evening last, and viewed by thousands. The sight of many incandescent electric lights shining beneath the water was indeed beautiful.

The Employes of the Edison General Electric Company, Chicago office, presented Mr. S. D. Greene, who has been acting manager of this office since May last, with a very elegant scarf pin set with diamonds and sapphires, in token of their esteem and appreciation of his kind and manly dealings with them.

The National Electric Manufacturing Company, of Eau Claire, Wis., is pushed to its utmost capacity, the factory running night and day. During the month of July this company report the closing of 16 contracts, aggregating 7,450 lights. The above company will soon place on the market an alternating machine without an exciter.

Mr. S. D. Greene, who has been acting manager of the Chicago office of the Edison General Electric Company, will soon leave for New York to fill the position as first assistant to Samuel Insull, second vice-president of the Edison Company. In Mr. Greene's management of the Chicago office there has been no better illustration of true business capabilities than displayed by him since last May. In that short time he has not only won the esteem and admiration of all who came in contact with him, but also the esteem and respect of all the company's employés, and it is with universal regret that they part with him.

Personal.—Samuel Insull, second vice-president of the Edison General Electric Company, and John Muir, general manager of the railway department of the same company, were recent arrivals in Chicago.

Chicago, August 26, 1890. D. B. D.

OUR PHILADELPHIA LETTER.

The Horn, Brannen & Forsythe Manufacturing Company, 427-433 North Broad street, is enjoying a good steady business in the electrolier and combination fixture line. Mr. Brannen thinks indications point to an excellent Fall trade.

Mr. Charles A. Bragg, of the Westinghouse Company, reports business booming as usual. A 600-light United States dynamo, with a Westinghouse compound engine to run it, has recently been placed in the Presbyterian Hospital in this city. The wiring of the building is something quite unique. The circuits are so arranged that it is impossible to be without light and possible to have none but the corridor lights in operation. Each floor is wired so that an attendant can light up any one room or ward without disturbing any of the others.

The Philadelphia Market House, probably the largest in the country, has just been equipped by Mr. Bragg with 40 of the new Westinghouse flat carbon arc lights and a 900-light United States incandescent dynamo. Three Westinghouse standard engines furnish the requisite power.

Marine Installations are quite a hobby with Mr. Bragg. The Clyde Line Steamer "Algonquin" has been very handsomely equipped with 250 incandescent lights.

The Export Coal Company's steamer "Carbonero" is lighted throughout on the United States incandescent system, has a 6,000 candle-power search light and Westinghouse engines. All the lighting, including the search light, is done by the same dynamo.

Each of Two Tugs belonging to the Norfolk and Western Railroad, is equipped with two United States dynamos, either one of which controls a 6,000 candle-power search light, lights the boat and furnishes current for two arc lights, each with 1,000 feet of cable attached. These latter are to place on wrecks or on a pier.

Jacob Read's Sons have recently placed in each of their large bulkhead windows, 40 United States incandescent lamps to take the place of arc lights formerly in use. One of these windows is said to contain the largest pane of plate glass in the world.

The Baldwin Locomotive Works are now equipped with 40 of the flat carbon Westinghouse arc lights.

The Media, Pa., Electric Light Company has recently increased the capacity of its plant by adding a 750-light Westinghouse alternator and engine.

The Allentown, Pa., Electric Light and Power Company has installed a 500-light Westinghouse alternator.

The Borough of Emaus recently started a Westinghouse alternating arc plant with great success. Since starting, the capacity has been increased 30 per cent.

Mr. Sawyer, of the Thackara Manufacturing Company, has been spending the past six weeks in California. He is expected back shortly.

Chadbourne, Hazelton & Company have all the work they can take care of at present. Mr. Stadelman, the chief engineer, is kept hustling installing Wenstrom dynamos and motors. These machines are meeting with the cordial reception they deserve.

Philadelphia, August 28. S. L. C.

OUR BOSTON LETTER.

The Eastern Electrical Supply and Construction Company has been organized with a capital of $50,000, and will locate at 74 Federal street, this city. They propose to carry a full line of supplies for electric light, railway, telegraph and telephone companies. They are to be the sole New England agents for J. H. Bunnell & Company, of New York, and have the control of the Auxiliary fire alarm for the territory of Massachusetts.

The City of Lowell under the new contract will pay 40 cents per light of 2,000 candle-power instead of 50 cents as heretofore. The hours are from one-half hour after sunset until an hour before sunrise.

It is Expected that the town of Wakefield will be lighted by electricity within a month. The Citizens' Gas Company has ordered the material, including a 1,500 horse-power boiler, for its new electric plant. The Wakefield and Stoneham Street Railway which is to be started in the near future will be supplied with electric power by the gas company.

The West End Railway Company will commence the new electric line to Egleston Square next Tuesday.

The Special Committee of the Providence city council have prepared a favorable report on the petition of the Union Railway Company for the erection of a trolley system on its lines in that city. A company of out-of-town capitalists has been formed to construct a trolley road from Providence to Pawtucket, and on the east side from Providence to Barrington, Warren and Bristol. The new company intend to use the double trolley system.

The New Electric Power Plant for the Lynn and Boston Railroad, which will probably be located on Broad street in Lynn, is to cost about $75,000.

The New Electric Light and power station in Beverly, work on which was commenced last Monday, will, when completed, be one of the finest stations in Essex County.

The Lawrence Board of Aldermen gave a hearing to the Merrimac Valley Street Railway Company last Monday night, on their petition for new locations and the right to operate all its lines by electricity. They propose to use the single trolley system. The New England Telephone and Telegraph Company sent a letter of protest, and the Aldermen reserved their decision.

A Meeting of those interested in the proposed electric road at Rockland, Mass., is soon to be called and a company formed. As soon as the charter has been obtained, the necessary $100,000 will be raised and work commenced. The first part of the road to be built will be from Rockland to Hanover and from there to South Weymouth and Abington.

The Essex Electric Street Railway after several trials have decided to abandon the vertical double trolley system and will adopt the horizontal double trolley. W. I. B.

Boston, August 30.

CONVENTION NOTES.

ADDITIONAL INTERESTING MATTER RELATING TO THE CAPE MAY ELECTRIC LIGHT CONVENTION.

Capt. Willard Linewire Candee shed the effulgence of his military countenance upon the assembled multitude.

Mr. A. B. Laurence, the well-known belt man, was present as the representative of the Shultz Belting Company, of St. Louis.

Mr. E. Parkinson had a big pocketful of circulars showing some belting installations by Chas. A. Schieren & Co., of New York.

President H. S. Winston, of the Illinois Electric Material Company, of Chicago, made many friends among the electric light men.

Mr. Chas. L. Tolles, of Hartford, in addition to ably representing the Jewell Belting Company, entertained his friends with a number of choice songs.

Dr. Schuyler S. Wheeler and Prof. Francis B. Crocker were both on hand. The Crocker-Wheeler Motor exhibit was very complete and placed advantageously.

C. G. Lyman, secretary, represented the Queen City Electric Company, of Cincinnati, at the Cape May Convention. His company manufactures dynamos and motors.

Mr. Geo. T. Manson was on deck as usual. He hasn't missed an electric light or telephone convention since the respective associations were originally honored with his presence.

The genial and able Mr. M. M. M. Slattery was most warmly greeted at the Cape May Convention. No man in the electrical field has more friends than this very ingenious inventor, and all are pleased to know of his pronounced success in his electrical work at Fort Wayne.

The Bryant switch people were out in force at the Convention, and in addition to being able and energetic, presented strong claims for the honor of being the handsomest electrical party. As they were under the leadership of Col. John C. English, it would be difficult to dispute this claim.

JEST FOR FUN.

Springfield, Ill., is now in a quandary as to the desirability of mules or electricity as a motive power for her street cars. Presumably there is a suspicion that both means are apt to shock one.—*Chicago Times.*

Judge—What is the man charged with?

Officer—Electricity, your Honor. He stole a battery.—*Texas Siftings.*

These electric executions
Are a grand device;
Like no other thing on earth,
Test a man's intrinsic worth,
For they kill him twice.
—*Texas Siftings.*

Now, if the strikers could only get points from a streak of lightning! Look at that strike.—*New York Evening World.*

"I seldom touch upon the subject," said the electrician when asked to explain electric currents.—*New York Tribune.*

The next convention of the National Telephone Association opens at Detroit, Mich., on September 9th.

The interesting analysis of voltaic action on telegraph lines published in last week's REVIEW touches a responsive chord in an old operator's experience, as Mr. Flanery's letter, published in another column, shows. What with air leaks and pole leaks, and a telegraph wire battery setting up a current on the line, it is not to be wondered at that so few telegraph companies pull through with the balance on the right side of the account.

Telephonic News

*** Bell telephone wires in Montreal, Can., are to be laid in subways.

*** It is expected that the telephone convention next year will be held in New Orleans. Many of the telephone men of the country have never visited this great city of the South, and will be pleased to take it in.

*** The Southern New England Telephone Company has agents at work taking an inventory of the stock in New Haven, Conn. All of the instruments used are rented from the Bell Telephone Company, and have to be accounted for annually.

*** Col. J. N. Keller, general manager of the New England Telephone Company, has returned from a European trip, having greatly enjoyed his brief vacation from the hard work which naturally comes from a man of his energetic nature when at the wheel.

*** The American Bell telephone output for the month ending August 20 was as follows:

	1890.	1889.	Inc.	Dec.
Gross output.....	4,322	4,302	20	....
Returned.	2,761	2,471	290	....
Net..... ...	1,561	1,831	....	270
Since Dec. 21.	1889-90.	1888-89.	Inc.	Dec.
Gross.....	42,686	38,640	4,046	....
Returned.....	17,752	16,142	1,610	....
Net	24,934	22,498	2,436	....

*** An independent bill has been introduced in both Houses of Congress giving the District Commissioners authority to fix all telephone rates in Washington and Georgetown, and stipulating that they shall not be more than $50.00 for special wires; $40.00 for wires with three subscribers, and $30.00 for wires with more than three subscribers. There is no probability that this bill will be passed this session.

A Chinese Telephone.

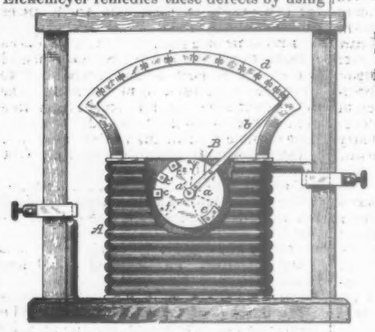
A press dispatch from San Francisco, Cal., states that the Sunset Telephone Company is likely to have a persistent rival in a party of Chinese in that city whose ingenuity has enabled them to perfect an instrument which works remarkably well, and, it is asserted, is not an infringement on the Bell patents. The new instrument was brought to light through an investigation of the telephone company, which became suspicious of the increasing number of orders for the removal of instruments from Chinese shops.

For many months Wong Ching Wah, otherwise known as W. C. Young, a highly educated and intelligent Chinese, has been engaged in electrical experiments with a view to perfecting his smattering knowledge of the science, obtained in an Eastern college. Wah is employed as a teacher in a Protestant Episcopal Mission at 915 Clay street, and has been able to prosecute his experiments only at odd hours when his services were not required at school. About a year ago he conceived the idea of attempting the construction of a telephone. From the electrical supply house on Mission street he purchased the necessary parts of instruments, and a wood engraver on Kearney street, under his Chinese customer's instructions, knocked together a box for the reception of the completed telephone. Wah screwed the parts together, and the result was so satisfactory that he straightway constructed a second similar instrument. This he set up in a neighboring meat shop, the first instrument having already been placed in position in the Mission. Wah and his meat shop friend strung a wire between the two points, and then each rushed home to his telephone for the first test. It worked like a charm, and within a week the proud electrician had received from his friends and acquaintances dozens of orders for similar telephones. He filled orders as rapidly as possible, and as fast as new instruments were completed and put in position, those of the Bell Company were removed.

SOME IMPORTANT ELECTRICAL PATENTS.

EICKEMEYER'S VOLT OR AMPERE METER.

In instruments as ordinarily constructed for measuring volts and amperes the indicating needle responds very slowly to variations of current, an incident ascribed by Mr. Eickemeyer to the fact that the indicators carry masses of iron of considerable bulk in which more or less permanent magnetism is developed. In the construction of his ampere meter recently patented, Mr. Eickemeyer remedies these defects by using



very small and separated masses of iron, which when magnetically influenced are capable of promptly moving the indicator, and in which the drag due to residual magnetism is not present. The engraving illustrates the new instrument provided with a coarse wire coil to indicate amperes; to indicate volts a fine wire coil would be substituted. A disk *a* of brass, rubber or other non-magnetic material has its axis journalled in the coil, so that the lower portion of the disk will lie near the center of the coil; a series of pins *f* are secured to the disk near the edge, over which little iron riders $c c^1 c^2$ may be fastened to the disk. These may be shifted to make the instrument sensitive to large or small changes of current. An aluminium index is secured to the axis of the disk. When current flows in the coil the bits of iron are drawn toward the center and the index shifted. The scale plate must be read according to a chart, as the reading must be interpreted differently with different adjustments of the bits of iron.

ELECTRIC POWER TRANSMISSION.

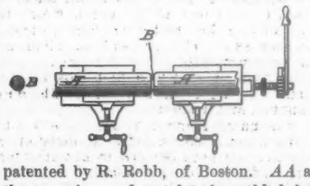
Prof. Elihu Thomson has recently patented a system of electric transmission of power in which a continuous current circuit and an alternating current circuit extend from the supply station to the motor station. At the former a continuous current generator and an alternating current generator are connected to the two circuits, respectively. Each driven motor, which is of the multipolar type, has its field magnets excited by the continuous currents, and its armature coils connected to the alternating current mains.

PREVENTING INDUCTIVE DISTURBANCES ON TELEPHONE LINES.

Prof. Thomson has also patented a system of electric power in which secondary batteries are placed in parallel with the car motors, the batteries being located at all points along the line where there is likely to occur a considerable increase of load upon the motors. The lowering of the speed of the motors at such points increases the flow of current and lowers the potential of the mains. The reflex action of the secondary batteries, it is claimed, prevents any great fall of potential, and thereby prevents serious interference with telephone lines which may lie in inductive proximity to the power circuit.

ELECTRIC WELDING.

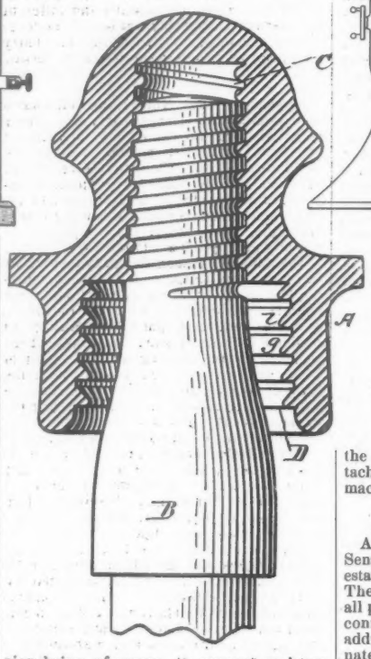
The accompanying illustration shows an improvement in electric welding recently



patented by R. Robb, of Boston. *AA* are the two pieces of metal to be welded, held in clamps, as usual. Instead of dressing off the abutting edges of the two pieces, so as to make them weld uniformly over the whole surface, Mr. Robb proposes to place between them a piece of metal of less cross section, which will, of course, for that reason, be rendered plastic sooner than the larger pieces. When this primer is softened by the current the two pieces are pressed together, causing the primer *B* to spread uniformly over the surface, thus conducing to a good weld. The piece *B* may be a disk of metal or a spiral of wire.

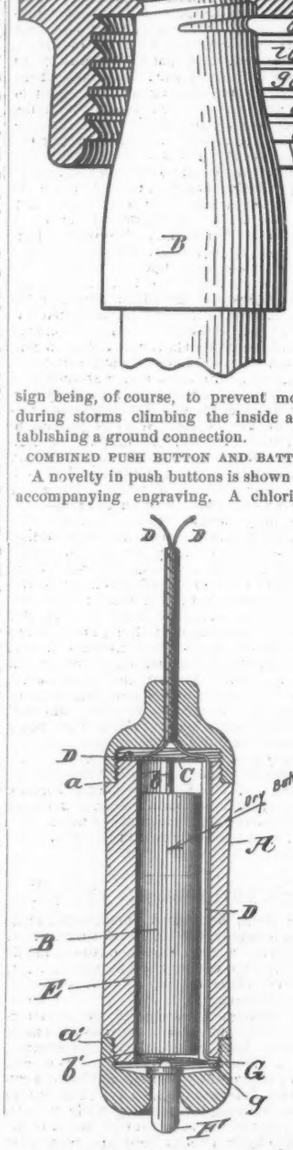
OAKMAN'S INSULATOR.

The accompanying engraving illustrates an insulator recently patented. The improvement consists in interiorly grooving the petticoat *A*, the design being, of course, to prevent moisture during storms climbing the inside and establishing a ground connection.



COMBINED PUSH BUTTON AND BATTERY.

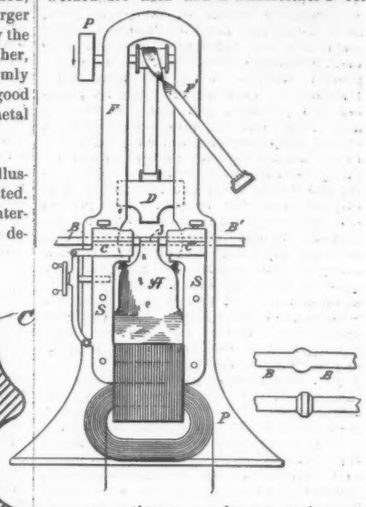
A novelty in push buttons is shown in the accompanying engraving. A chloride of



silver battery *B* is mounted in a wooden case provided with screw caps. The zinc element b^1 of the battery is in operative relation to a terminal *G*, which may be caused to close the circuit by push button *F*.

ELECTRIC WELDING AND SHAPING.

In the accompanying engraving we illustrate an improved welding and shaping machine, invented by Prof. Elihu Thomson. As will be understood after an inspection of the illustration it comprises a pair of clamps CC^1 in which the two pieces of metal to be welded are held and a transformer *P* for



converting a supply current into one of great quantity or heating power. A dieblock or anvil is provided upon which the edges to be welded are laid, and a drop hammer *D* is provided for shaping the joints, when the weld has been made, into the desired shape. The apparatus is provided with means for bringing the clamps toward each other when the metal has been rendered sufficiently plastic by the current to establish a weld. The detached views show the product of the machine.

Another Postal Telegraph Bill.

At the instance of the Postmaster-General Senator Sawyer recently introduced a bill to establish a limited postal telegraph service. The bill, among other things, provides that all post offices, wherever feasible, shall be connected with telegraph stations, and, in addition, the Postmaster-General may designate other post offices and telegraph offices as postal telegraph stations. The Postmaster-General is further empowered to contract with one or more lines of telegraph companies now in existence for a period of 10 years, and rates for this service are to be established as follows:

For the first 20 words or less, counting address and signature, between postal stations of the same State and less than 300 miles apart, 15 cents.

Between stations more than 300 miles apart, and not in the same State, 25 cents for the first 20 words or less. No rate shall be greater than 50 cents for 20 words. This is considerably lower than the present Western Union day rate for the distances given. It is further provided that within two years after the passage of the bill, one-half of the postal telegraph stations contemplated shall be connected by the wires of the companies receiving the contract, and within the next succeeding year at least one-half of the remainder shall be so connected. The bill empowers the Postmaster-General to prescribe the rules and regulations for carrying out the purposes of the bill. The measure is well calculated to bring about a reduction in the existing telegraph tolls without working a particular hardship upon the companies who, under contract with the government for a whole decade, are assured a certain and adequate income during the life of the agreement. The bill is a step in the direction of cheaper and more rapid correspondence, and, should it become a law, will place the people of the United States upon an equality with those of England, Germany and France, without the necessity of a government control of the telegraph which, for political and State reasons, is open to some objections in our Republic.

The Anvil Chorus.

Mr. Patrick Sarsfield Gilmore, who has just finished a very successful season with his famous band at Manhattan Beach, made a novel use of the electric current to heighten the effect of one of his most popular numbers, the "Anvil Chorus." When the hammers are supposed to strike the anvils, Mr. Gilmore presses, in time with the music, a row of push buttons fastened to his music stand. These buttons are connected into circuits which run to a battery of cannon placed on the lawn outside the band stand. As each button is pressed a gun peals forth, the music ending with a rattle and bang which is decidedly startling.

Air as a Conductor of Electricity.

To the Editor of Electrical Review:

That is a most interesting and valuable research of Mr. Bennett's, which you publish in the Review of August 23d. It is strange that such work as this is all done on the other side of the Atlantic, that no one in the service of the Western Union or the other telegraph companies on this side, which are daily stringing copper wires, should have discovered so important a source of trouble.

The galvanic action between the copper and iron or galvanized iron, which as we know is zinced iron, is reasonable, and can be readily accepted by those telegraphers who have taken the trouble to study the chemistry of the battery and the source of E.M.F. Of course, the film of moisture along the supports is the electrolyte between the copper and iron wires which are the plates or electrodes. This action between copper and galvanized (zinced) wires will explain to some extent a portion of the trouble experienced in working quad circuits on copper wires strung beside galvanized wires and *vice versa*. A quad battery of 350 volts soon makes itself felt on this principle. Moreover, the zinc being the sacrificial metal, will, wherever they are brought in contact by moisture, be wasted or worn away even without the aid of any battery current except such as generated naturally between them. This paper of Mr. Bennett's ought to receive quite a welcome from those who have the care of quadruplex and other multiple telegraphs, but then they do not put men in care of quads now who have even a slight appreciation of such refinements.

The experiment with the deal plank and the box with bronze wire I have made substantially myself, it being suggested to me in an unexpected or accidental manner. One day stepping on a moist place about five feet square around an operating table, I reached out to open the circuit, and my fingers touching the metal of the key, I received a smart shock. This surprised me, for there was a wide margin of dry floor around the wet place upon which I was standing, and the floor is 40 feet square and 50 feet above ground. I touched the key again and then the binding screw of the relay, and got a shock each time. Close examination satisfied me that there was no ground or leak through the floor, and I concluded that the film of moisture made by mopping the floor was charged like one side of a condenser with the other side insulated, or like a long well insulated wire with the distant end open.

Now, a person in a perspiration standing on an insulated support would, upon touching a highly charged wire, get quite a shock, depending upon the superficial dimensions of the body and its distance from a wall or other nominally poor conductor, the air between the person and the wall being the dielectric. I have read of several accidents, in the New York *Herald*, which seemed to give the particulars clearly which I could account for in no other way. In one or two cases the persons had but one hand on a wire or switch handle and were knocked off step ladders, and as far as the description went there was no possible way of making a circuit. So then such accidents are apparently the effects of a condensing action. But they have not been so explained, so far as I know. It seems to me that the expert has pushed the electrician aside, and audacity, always a strong face, still rules the hour.

I was very glad to see Mr. Bennett's statement in reference to conduction by moist air, as it throws the first publicly expressed doubt upon the time-honored belief that the atmosphere is at all times a non-conductor. My experience of daily tests for two or three years at New Orleans on new lines, new wires, new poles, new well-painted arms and new conical glass, led me to doubt the general belief. For on some mornings the insulation would fall to 75,000 per mile and even lower, and, so far as I could see, there was no cause for it, as there had been no rain and the morning was not apparently unusually damp. But on all mornings of such low insulation, the Government hygrometer registered 90 and upwards. It is a fact, of my own experience, that with the hygrometer at 95 there is not insulation sufficient to work, without considerable difficulty, a circuit 150 miles in length or even a less distance.

When we reflect that at a temperature of 77° F., which is common at New Orleans, a cubic foot of air contains ten grains of water, and that electricity, like light, is only cognizable in contact with matter; also, that when new matter comes within the field of the force acting within and around the wire, that the something usually called ether within and around the new matter becomes cognizable as electricity; then it is not easy to see why, in view of "the modern theory," the field surrounding the wire should not be extended considerably into the moist air, though not far enough to reach the ground, and proportionately exhaust and monopolize the sending current along the wire's whole length.

Be this as it may, Mr. Bennett has given us a very valuable paper, and we will always be glad to hear from him.

David Flanery.

Memphis, Tenn., Aug. 25, 1890.

Contracts Made by Mail or Telegraph.

The question of rights and liabilities under contracts made by correspondence, or a series of letters or telegrams to and from some one in another city in relation to mutual business transactions, is one that is frequently arising in business life, says the *American Merchant*, and with the principles of law governing such contracts or such correspondence it will be advantageous to most business men to be familiar. Contracts thus made are in their nature the same as all other contracts and governed by by the same rules, viz., there must be parties capable of contracting, a subject matter to be contracted for, a sufficient consideration, and an assent by each party to the terms proposed by the other. The only difference is in the time of the assent or completion of the contract, and it is of the rules governing the determination of this question only that we propose to write now, and to give only those more familiar rules that are well established by adjudicated cases.

An offer made by mail or telegraph is a continuing and open proposition until its receipt by the party to whom it is addressed, and such reasonable time thereafter as will enable him to accept or refuse it, or until actual notice of its withdrawal by the party making the offer reaches the party to whom the offer has been made; and any act done by that party evidencing an intent to accept it before actually receiving such notice of its withdrawal, is a completion of the contract.

It may be withdrawn by the party making it at any time previous to its acceptance by the other, but this notice of withdrawal is not operative until it has actually reached the party to whom it is addressed.

For instance: If A should write to B, making a certain offer for certain goods, and B should write accepting such offer, the contract would be completed at the time B posted his acceptance, although A might, in the meantime, have written another letter withdrawing his offer, providing that B had mailed his acceptance before receiving the notice of withdrawal. In other words, the contract is complete at the time of mailing the acceptance of the offer and not at the time of the receipt of such acceptance by the party making the offer.

Should B delay his acceptance, however, until the receipt of the notice of withdrawal, no acceptance then made could operate to bind A to the contract.

The offer need not be revoked in the same manner as it was made either, and should A, after making an offer to B, alter his determination and telegraph B to that effect, which telegram was received by B previous to a receipt of the offer or its acceptance by him, it is a complete withdrawal.

The entire question in each case is, has there been an assent to the terms offered before the offer was withdrawn? If so, there is a complete contract, which can only be rescinded by the assent of both parties, while before such acceptance its terms are constantly open to change or modification by either.

Three different companies are asking for a franchise to supply Ashtabula with an electric street railroad.

Byrnes and the Telegraph.

Through the operating room in the basement of the white marble building in Mulberry street used as Police Headquarters is sifted all the disturbing news of the city, says the New York *Sun*. The telegraph operators who are on duty there day and night are in constant communication with every precinct of the police department. When it becomes necessary, as it has during the present railroad strike, to mass the police at different points where trouble is expected, it is of vital importance that all the wires running into this room should be in working order.

When the strike on the New York Central road was declared, on Friday evening, two weeks ago, the police wires on the east side above Fourteenth street did not respond, and it was only through the ingenuity of a bright young lineman that the break was repaired. The accident caused Inspector Byrnes a deal of worry. He knew on Friday afternoon that a strike was imminent, and he had notified the captains of precincts through which ran the Central's tracks to hold all reserves in readiness. Capt. McElwain telegraphed to him at 6.45 that the strike was declared. Inspector Byrnes was acting superintendent, and as there was a good many ugly rumors afloat it was considered necessary to order out extra men. Old "Pop" Stevens, the veteran telegraph operator, was instructed to send out such an order. He tried the wires, and not a police precinct above Fourteenth street on the east side responded. Mr. Stevens rushed into Inspector Byrnes' office in great excitement with the news. The inspector, to avoid arousing the suspicions of the newspaper men who were at headquarters, went down to the cells on the basement floor, and by climbing through a rear window, entered the operating room and locked the door. The wires were tried again without response. Four linemen were sent out to find and repair the break, and orders were sent over the Western Union wires to 40 detectives of Inspector Byrnes' staff to report at once at Police Headquarters. These men were stationed along the east side precincts where they could get telephones, and were instructed to keep the Central Office informed of the actions of the strikers.

At eight o'clock the linemen reported that they were unable to locate the break in the police wire. In the meantime Sergeant-Detective Mangin telephoned from the Murray Hill Hotel that the signal station switches at Fifty-seventh street were threatened. It began to look as if the police were going to have a busy night. Inspector Byrnes sent the linemen out again, and an hour later they came back unsuccessful. One of them named Lyman then declared that he was going to find that break if it took all night. At 11 o'clock Lyman returned.

"If you will let me steal a Western Union wire, Inspector," he said, "I can put your wires in working order."

"Take all the wires you need, and the poles with them," was the answer.

Lyman hurried out, and within an hour Pop Stevens was rubbing his hands in high glee and Inspector Byrnes wore a broad smile. Lyman completed the circuit by using a Western Union wire from Fourteenth to Thirty-fifth streets. The break was repaired the next day.

"You don't know what a load was taken off my shoulders," said Inspector Byrnes, in telling the story, "when Lyman's success was evident and the upper precincts responded to the wires."

.... Some time this week the Western Union Telegraph Company will move into its new offices at Denver, Colo.

.... The stockholders of the Postal Pacific Telegraph Company last week had an election at 1 Broadway and re-elected the following directors for the ensuing year: J. W. Mackay, W. G. Van Horne, Sir George Stephen, C. R. Hosmer, R. V. Day, A. B. Chandler, Hector de Castro and G. G. Ward. The election of officers will take place at the annual meeting of the company early in September.

.... In a letter to the New York *Sun*, Mr. Stephan Vail, of Morristown, N. J., states that Professor S. F. B. Morse was the superintendent, and his father, Alfred Vail, the assistant superintendent of the first telegraph line ever constructed. They were appointed as such by the Secretary of the Treasury, under whose direction had been placed the disposition of the $30,000 appropriated by Act of Congress to construct the line, that extending from Washington to Baltimore.

TELEGRAPHIC

What General Bangs Overheard on the Wire.

Now Jones had left his new-wed bride to keep his home in order,
And hied away to the Hurrum Hills above the Afghan border,
To sit on a rock with a heliograph; but ere he left he taught
His wife the working of the code that sets the miles at naught.
And love had made him very sage, as nature made her fair;
So Cupid and Apollo linked, per heliograph, the pair.
At dawn, across the Hurrum Hills, he flashed her counsel wise—
At e'en the dying sunset bore her husband's homilies.
He warned her 'gainst seductive youths in scarlet clad and gold,
As much as 'gainst the blandishments paternal of the old;
But kept his gravest warnings for (hereby the ditty hangs)
That snowy-haired Lothario, Lieutenant-General Bangs.
'Twas General Bangs, with aid and staff, that tittupped on the way,
When they beheld a heliograph tempestuously at play.
They thought of border risings, and of stations sacked and burnt—
So stopped to take the message down—and this is what they learnt:
"Dash dot, dot, dot, dot dash, dot dash dot," twice. The general swore.
"Was ever general officer addressed as 'dear' before?
'My love,' i' faith! 'My duck,' gadzooks! 'My darling popsy-wop,'
"Spirit of Great Lord Wolseley, who is on that mountain top?"
The artless aid-de-camp was mute; the gilded staff was still,
As, dumb with pent-up mirth, they booked that message from the hill;
For clear as Summer's lightning flare, the husband's warning ran,
"Don't dance or ride with General Bangs—a most immoral man."
(At dawn, across the Hurrum Hills, he flashed her counsel wise—
But, howsoever love be blind, the world at large hath eyes.)
With damnatory dot and dash he heliographed his wife
Some interesting details of the General's private life.
The artless aid-de-camp was mute; the shining staff were still,
And red and ever redder grew the General's shaven gill.
And this is what he said at last (his feelings matter not):
"I think we've tapped a private line. Hi! Threes about, there! Trot!"
All honor unto Bangs, for ne'er did Jones thereafter know,
By word or act official, who read off that helio.
But the tale is on the frontier, and from Michni to Mooltan
They know the worthy General as "that most immoral man."—*Rudyard Kipling.*

.... There will be a large number of electrical exhibits at the annual fair of the Massachusetts Charitable Mechanics' Association, to be held in Boston during October and November.

.... District messenger service is only now being introduced in London, a company having been organized with a capital of $1,000,000, and appealing to American experience to show that there is "money in it," in a long prospectus describing how messengers, cabs, fire and police alarms, etc., can be sent, which is somewhat funny reading, considering how old such service is here. An American, R. D. Radcliffe, has been engaged to superintend the business until it is in working order.

.... The signal service of the army will not send an observer to Bermuda, as was thought likely when the cable between Halifax and Hamilton was opened. This position is a valuable one for weather prognostics, especially those regarding ocean influences. The direction and force of the South Atlantic hurricanes, due about this time of year, are indicated at Bermuda. This information, of such obvious value, was desired by the Signal Office of the army and the Hydrographic Office of the navy. The former service has long been anxious to extend its lines of prediction beyond the coast line, and to furnish advance information to the mariner as well as the farmer. The Hydrographic Office, while not desirous for this kind of labor on account of inadequate appropriations, has been called upon so often by oceanic vessels for information that it has already gained a reputation for reliability. An office at Bermuda would have been of special value to this service, between which and the Signal Office a sort of rivalry has sprung up. The Signal Office has made arrangements with the Canadian Weather Bureau for the Bermuda reports, and will utilize them.

* * Charter applications for two electric railways have been made at Uniontown, Pa.

* * Fans driven by electric motors are to be put up in parlor cars of the Chicago and Alton, according to report.

* * A large quantity of electrical machinery shipped by a St. Paul, Minn., company, has been seized at Winnipeg for undervaluation.

* * The Minneapolis Street Railway Company has ordered two belts, each 150 feet long and six wide, to transmit 2,000 horsepower.

* * The Aurora, Ill., Street Railway Company expect to let the contract this week for their power plant, car barns and smoke stack.

* * The last of the equipment for the Johnstown Passenger Railway has been shipped by the Short Electric Railway Company to Johnstown, Pa., and the road will be put into operation within a few days.

* * The Villard syndicate will expend about $1,600,000 in reconstructing their street car lines in Milwaukee. All the rails will be replaced and the roadbed relaid. The electric equipment will cost over $1,000,000.

* * One thousand men are at work on the track of the electric street railway on Madison and Lake streets, in Chicago. The track has reached Austin avenue, and cars will be running on those streets before snow flies.

* * At a special meeting of the stockholders of the Connecticut Motor Company, it was voted to increase the capital stock from $30,000 to $40,000, the present stockholders to be given the preference in subscribing for the increase until October 1.

* * Work on the new consolidated electric power station at Toledo, O., is to be commenced immediately. The wharf and foundations are completed. It is the intention of the company to utilize the wharf as a landing for excursion steamers next season.

* * An electric boat, designed by D. B. Stevens, of Toronto, crossed to the island in Toronto Bay one day last week. The trip was made in 16 minutes. This is the first attempt that has been made in Toronto to utilize electricity as a motive power on the water.

* * The Short Electric Railway Company will issue a new illustrated circular of their generators, motors and appliances, by the 1st of October. This company has received an order for the partial electrical equipment of the Syracuse and Onondaga Railway at Syracuse, N. Y.

* * It is reported that an electric railway in Siam has been incorporated and will be built at once from Bangkok to Paknam, a distance of 30 miles. This road is to cost $400,000, and Siamese capital will be used. An electric light company has also been organized and the plant ordered for Bangkok.

* * Memphis ought to make a careful enumeration of her population before electricity is applied to the street cars. When that notable event comes to pass there is danger of thousands of her people being drowned in the river in their frantic efforts to escape from the unseen power.—*Nashville, Tenn., American.*

* * The first electrical railway in Sweden has been completed. It is situated at the Boxholm Iron Foundry, and works capitally. The whole installation has only cost £750, of which the locomotive absorbed £390. It is worked through dynamos already in use for the electric light, which accounts for its cheapness.—*Railway News.*

Reed's Lake Electric Railway.

An electric railway on the overhead system was formally opened on August 3d, at Reed's Lake, Mich. The installation was by the United Electric Traction Company, of New York. Great credit is due Mr. V. H. Yarnall, of this company, for erecting the plant in a very short time and highly satisfactory manner.

The road is a small one, being equipped with only two cars. The cars contained 127 passengers at the time the photograph was taken. The schedule speed is 20 miles an hour for a distance of three miles, and so far there has not been a single delay since the opening of the road.

We also present on this page a view of one of the aisles in the assembling shop in the factory at Jersey City of the United Traction Company. In the right middle ground are shown the frames of several of the latest 30 horse-power type traction motors. The room shown is the only one in the large factory driven by belt and shafting, all the others being supplied with motors. The output of the factory at present is one car motor per day.

During the last week this company has made a sale of several storage battery cars, to be used on the Citizens' Street Railway Line in Indianapolis, Ind., the terms being sight draft on receipt of bill of lading. This is noteworthy as perhaps the first outright sale of storage cars without a preliminary "experiment," and is strong encouragement for the manufacturers.

View of the Reed's Lake Electric Road.

Interior View of the Factory of the United Electric Traction Company.

Counted By Electricity.

The Population Division, Census Office, celebrated the completion of the count of the population of the United States by a dinner at "Glen Echo Heights." Superintendent Porter, in expressing his congratulations upon the rapid and accurate completion of this great work by means of the Hollerith electric computating system, made some interesting statements as to how it has all been accomplished.

"For the first time in the history of the world," said he, "the count of the population of a great nation has been made by the aid of electricity. The number of names on every 15,000,000 schedules has been registered twice by the nimble and expert fingers of the counters, and the 64,000,000 people have marched, as it were, under the vision of the young men and women who have done such remarkable work with such extraordinary rapidity and precision. What a procession you have had pass before you! The men who wrote those names have had to find them in every human habitation and existing under every imaginable condition within this vast domain of ours. In June these blanks were distributed throughout the country. In July and August they found themselves back in the census office counted twice and ready for the next statistical treatment. Allowing for the time spent in teaching and in fitting up the machines, the count proper was not commenced before July 1, and the night force was not organized until some time afterward.

"We have actually counted 128,000,000 in six weeks, or the entire population of 64,000,000 twice in that period.

"Beginning with 2,000 and 3,000 families, or 10,000 and 15,000 persons per day, the operatives progressed in dexterity, until last Thursday no less than 43 counted over 10,000 families, or 50,000 persons, each. One young lady reached the astonishing total of 16,071 families, or about 80,000 persons. On that day not only the highest averages were reached, but the greatest number was counted, the report showing 1,342,318 families, or 6,711,590 persons. This represents an average of 8,135 families, or 40,675 persons per clerk. The average number counted by the women clerks was 9,590 families, or 47,950 persons, and by the men clerks 6,587 families, or 32,935 persons. Thus it will be seen that the women average nearly one-half more than the men. It is also worth noting that of the 43 who counted more than 10,000, thirty-eight were women.

"Estimating the population of the civilized world at 650,000,000, we could count it in 100 days, while the bright young women and sturdy young men of our population division could run through the entire population of the earth which, including Asiatics and savages, is estimated at 1,300,000,000, in less than 200 days. And while we thus glorify our own little achievements, we must not forget that we have here with us the modest man who invented the wonderful machine with which we have accomplished such results."

On Units of Light and Brightness.

BY PROF. LEONHARD WEBER, BRESLAU.

Unit of superficial brightness: Important, but neglected. Suppose a luminous point be the source of light, the intensity of which is, I say, so many candles; then at the distance, d, the quantity of light which falls on a surface (at right angles to the rays of light), the superficial area of which is a, may be represented by $q=Ia/d^2$. But if we take into account the superficial brightness or brilliancy of the source of light we must substitute for the term I, or the intensity of the source of light, another term, namely, A B., or the product of the area and the brilliancy of the source. Similarly we may consider the brilliancy of illumination of the area illuminated, and this brilliancy (which we may represent by b) is found by dividing the quantity of light falling on the whole of that area by the area itself; that is, $b=q/a$. Thus we have three simple algebraic equations connecting the terms of our statements; these being (1) $q=Ia/d^2$; (2) I=A B; (3) $b=q/a$. To use these equations it will be necessary to fix our units of reckoning. Suppose we use, as the unit of bright or illuminated area, the square centimeter, and as the unit of distance the meter; then the second equation shows that the brilliancy, B, of an extended source of light is unity when it gives as much light per square centimeter (off its own area) as a luminous point of unit intensity would give at the same distance; and by combining equations (1) and (3) above we get the equation $b=I/d^2$, which means that the brightness of the illuminated surface is unity when it gets as much light from the source as it would have got from a unit source of light at one meter distance; this being the basis of measuring illumination, as distinguished from light, in "meter candles" (or "foot candles"). If we start from a unit of brilliancy instead of a unit of intensity we will arrive at corresponding values, but in every case we must distinguish between the actual intensity of a source of light, or quantity of light, falling on an illuminated area on the one hand, and the brilliancy of the source, or brilliancy of illumination, on the other. Now, the great difference between the platinum unit and the candle is that the latter is a standard of actual intensity only; while the former since it defines the area of the source, is a standard both of intensity and of brilliancy. The amyl-acetate lamp gives a flame of about 2.27 sq. cm. in effective area; so that its actual lighting power being so-and-so in platinum units, its brilliancy will be less in the ratio of 2.27 to 1.

The range of brightness or brilliancy is extreme. A sheet of printed paper which we can just read is some thousand millionfold less bright an object than the sun at noonday; but the estimation of brightness is a matter of increasing importance, both with regard to the source of light and to illuminated objects; and the use of a standard of brightness will help to make clear our comparisons. From this point of view, the actual light from a platinum unit being about 20 times that of an amyl-acetate lamp-flame, and the area of that flame being 2.27 sq. cm., the brightness of the platinum may, if we please, be represented as 20 in amyl-acetate units, and that of the flame itself as 0.4. On the same basis the brightness of the sun is about 160,000, that of the sky 0.1 to 1, that of a printed paper which we can barely read 0.00006, and that of a barely visible surface 0.0000001.

A convenient subsidiary unit of comparison is the brightness of a piece of white paper at a distance of one meter from a unit source of light, and itself serving as a source of light, the brilliancy of which may be taken as a standard. But perfectly white matt surfaces cannot be obtained, and only approximate results could be reached in this way. It might also be of great advantage to use multiples of the unit of brightness, micro and macro-units, as is now done with other units of measurement.

If the amyl-acetate lamp be adhered to, it might be used as a unit standard of brightness by taking only one sq. cm. of the flame; then other flames would be equally bright if one sq. cm. emitted the same quantity of light, and so on in proportion.

The following data, partly obtained in the laboratory here, and partly due to Dr. Michalke, Trebnitz, will illustrate this matter:

For red light (wave-length=640 ten-millionths of a centimeter) one pt. unit=15.75 amyl-flames; for green light (w.-l.=541) 1 pt. unit=20.4 amyl-flames. Sperm candle =1.12 amyl-flame (Weber); 1.17 (Liebenthal). Violle makes the pt. unit equal in respect of white light to 18.5 sperm-candles; whence it would be equal to 20.7 amyl-flames (Weber) or 21.6 (Liebenthal) [its *brightness* will therefore be to that of the amyl-acetate lamp flame in the ratio of 20.7 to 0.4, or 83 to 1].

TABLE OF RELATIVE BRIGHTNESS.

	Through red glass	Through green glass.
Platinum, incandescent just before melting	1	1
Sun's disc	4092	8417
Sky near the sun's disc	1*	1*
Albo carbon burner, edge on	0.615*	0.509*
White paper, bright summer (Breslau, June 12, 1885, 12 noon), horizontal, exposed to whole sky	0.138	0.295
White paper, sun 60° high, paper facing towards sun	0.069	0.144
White clouds shone upon by sun	0.021	0.089
Albo-carbon burner, face on	0.068*	0.073*
Argand burner	0.057	0.044
Clear sky at right angles to sun, sun being 60° above horizon	0.008	0.05
White paper on a dark winter's day lit by whole sky (Breslau, Dec. 22, 1884, noon)	0.0010	0.0030
Black velvet, bright summer day (Breslau, June 12, 1885, 12 noon), exposed to whole sky	0.00028	0.00059
White paper, reading without straining	0.000015	0.000020

*About.

New Work of the Westinghouse Company.

The San Antonio Gas Company, of San Antonio, Texas, appears to be well satisfied with the working of the Westinghouse alternate current incandescent system. It has at present in operation Westinghouse apparatus to a capacity of 1,500 lights, and is just placing an order for a 750-light increase.

Our Spanish-American neighbors are beginning to see the advantages which electricity possesses as an illuminant. Some time ago the Westinghouse Company sold a 1,500-light alternate current incandescent outfit to be used toward dispelling darkness in the Brazilian town of Juiz de Fora. The Juiz de Fora Company is well pleased with its purchase, and has just asked the Westinghouse people to ship a 750-light machine to supplement the present capacity of its central station.

There is no lack of enterprise in the new State of Washington. The towns of the State are rapidly adopting electricity for lighting and motive power purposes. The electric lighting company of New Whatcom has decided upon the Westinghouse alternate current system and will immediately install a 750-light plant.

One of the progressive towns of the vast and rich mineral State of Montana is Anaconda. An electric light company has been formed in Anaconda, and the Westinghouse incandescent system has been chosen. The plant will have an initial capacity of 3,000 sixteen candle-power incandescent lamps, and 60 arc lights.

The Turtle Creek Valley Electric Company, of Wilmerding, Pa., is about to add a 60-light arc machine of the new Westinghouse alternate current type to its central station equipment. It already has in service 1,500 lights capacity of Westinghouse incandescent dynamos.

The Philadelphia market house is to be illuminated by the Westinghouse alternate current arc lighting system in the near future. The Westinghouse Company has sold the city officials a 40-light plant for use in the market house.

Electric Shock.

The following is a letter sent to the editor of the *Times and Register*, of this city:

Wm. R. Male, white, aged 21 years, an employé of the U. S. Electric Company, while fixing the carbons, received a shock of 2,000 volts, the current entering through a hole in his rubber glove at the second phalanx of the middle finger of the right hand and passing out through the left forearm, charring the flesh at both places. The current lasted only three or four seconds. In describing the sensation he said there was no pain, but he felt as if he were violently shaken, and then lost consciousness. He was unconscious about five or six minutes. He then walked to the Emergency Hospital, where the burns were dressed. Said he felt all right, and was going to work the rest of the night. For several days he felt sore all over his body, as if he had been taking violent muscular exercise, but not enough to stop him from work.

R. M. ELLYSON, M. D.,
Resident Physician.

EMERGENCY HOSPITAL, WASHINGTON, D. C.

The Dynamo as a Motor.

The easy convertibility of a generator into an efficient motor was demonstrated lately in a very satisfactory manner at the Manningham Silk Mills of Messrs. Lister & Company, Limited, Bradford. During the recent overhauling of one of the main engines, which worked the machines in the batting, shearing and finishing departments, it was found that repairs had to made which would take up so much time that unless substituted power could be obtained these important departments would be stopped, and a number of hands would be idle. As no ordinary or ready means were available for this object, it was suggested by the electrician of the firm, Mr. Edwin Preece, that the dynamo used for the lighting of this department should be tried as a motor in place of the engine under repair. Permission having been granted for this trial, the electrician, assisted by Messrs. Andrews and Preece, Limited, Borough Mills, Bradford, quickly made the necessary arrangements, and the dynamo was very shortly at work driving the shaft.

In an article which we published on June 20, describing the installation at the Manningham Mills, it was pointed out that one portion of the mills was lighted by a "Preece" 500 ampere dynamo, driven by an independent Robey engine, whilst the other portion of the mill was lighted by a similar dynamo, driven by a clutch arrangement from the main engine of the mill (which was the one broken down). The two systems of lighting were, as explained, connected together by mains governed at each switchboard by a double plug switch, with only one pair of plugs, in order to avoid confusion; but under the altered circumstances, it was necessary to connect up the plug switch at each board, consequently, a second pair of plugs had to be obtained; the arrangement was then complete, after the ropes from the flywheel had been disconnected from the main driving pulley in the shaft. The Robey engine was started, driving the dynamo attached to it and generating a current which was transmitted to the second dynamo by means of the conducting wires and the double connection of the switchboards, the second dynamo then—its brushes being reversed—became a motor, and, being clutched on to the main shaft by means of its own countershaft, produced sufficient power to work the various machines required in the department.

The whole arrangement was completed in about an hour after the decision had been arrived at, and the machinery was started without the slightest hitch whatever. The current passing into the motor varied from 250 to 500 amperes, according to the different loads, at a potential of 115 volts; it was kept running for about 36 hours without one single stop or the slightest interruption whatever. The remarkable self-regulation and regularity of speed under different loads, was an agreeable surprise to the principals of the firm, who were so well satisfied with the new arrangements that in all probability a further development of electricity as a motor may be decided upon. This is, we believe, one of the few instances where a dynamo has been utilized to take the place of the steam motor which usually drove it, and thus enable the operations of the factory to be carried on with but the slight delay due to the necessary alterations in connection. The whole operation reflects credit on those engaged, and demonstrates the extraordinary value of the dynamo-electric machine.—*London Electrical Review.*

ELECTRIC LIGHT NEWS

—— The new electric light station at Pittsfield, Mass., is to cost $30,000.

—— The new opera house in Pueblo, Col., has its own electric light plant. The building will contain over 1,800 lights.

—— The Quincy, Mass., Electric Light and Power Company has voted to increase the capital stock from $60,000 to $100,000.

—— McVicker's Theatre, in Chicago, was almost totally destroyed by fire early in the morning of August 26th. This was one of the first theatres in this country to install an electric light plant of its own.

—— The Cambridge, Mass., Electric Light Company has this month paid a semi-annual dividend of three per cent.

—— The Sedalia Electric Light Company, of Sedalia, Mo., which has been operating an alternating current electric light plant of the Westinghouse system for over a year, is about to enlarge its capacity. The company has just contracted for a 750-light alternating current apparatus with the Westinghouse Electric and Manufacturing Company. This will give the plant a total capacity of 1,500 lights.

—— The Thomson-Houston Electric Base Ball Club, Lynn, Mass., will hold their second annual picnic and base ball tournament Saturday afternoon and evening, September 6. A purse of $25 will be given to the best local club, barring the Electrics. There will also be a purse offered for the best club in the Thomson-Houston Electric Company's works. The games are to be of five innings each.

—— The Westinghouse Electric and Manufacturing Company has received the contract for a 500-light alternate current apparatus from Traverse City, Michigan. The electric light company at that place has been operating the Westinghouse alternate current incandescent system for some time, but the demand for incandescent lighting has grown so rapidly that this increase has become very necessary.

—— A case has just been decided in England, involving the question, how far companies in carrying electric wires along public roads are justified in lopping trees, which, whether growing upon or overhanging the highway, interfere with such wires. The decision establishes that if an electric lighting company in carrying their wires along a public road within the limits allowed by their statutory powers, find it impossible at any particular point to avoid trees either growing up or overhanging the road, they are justified in lopping them as far as may be necessary. They must not be lopped more than is necessary, and the owners should be compensated for the damage done.

—— The proceeds of the mortgage for $75,000 recently given by the Camden Lighting and Heating Company, to the New Jersey Trust and Safe Deposit Company, to secure bonds, will be used in enlarging the plant and an increase of the machinery. A 700 horse-power engine will be added, and about 5,000 incandescent lights and 300 arcs. The work of making these additions will be commenced immediately. The Messrs. Cramp & Son, the well-known ship builders, will supply the new engine, and George V. Cresson the shafting. In addition to the above, a portion of the money will be used in extending the circuits for lighting the southern section of the city, the plans for which have been perfected.

—— There was a fight one day last week in Baltimore, Md., between Mr. Gomport Blum, a gray haired old man, and a number of employés of the Brush Electric Light Company, who were trying to string six wires on a pole they had planted in front of Blum's house. The pole had been planted during the night against Blum's remonstrance, and when the men came to string the wires they found Blum and his servant girl to oppose them. One of the employés passed the old man, but when he got near the top of the pole Blum had got an axe and began to chop away at the pole. When he got tired he let his servant girl do a little chopping while he protected her. Finally, the man on the high perch began to grow frightened at the weakening of his support, and he came down, leaving a temporary victory with the old man. The linemen returned later in the day and got their wires up.

Electrical Execution.

BY G. P. HACHENBERG, M.D., AUSTIN, TEXAS.

It appears the press has freely delivered itself on electrical execution as it was enforced in Kemmler's case. The subject was a most favorable one to play on the feelings of the masses, therefore it was necessary to make it a most horrible affair. But in that transaction there is a certainty that death was less painful than hanging, which is often associated with a lingering process of suffocation, and a thousand times less revolting than decapitation. Yet Kemmler's execution was a bungling affair, not that it inflicted the least pain on the criminal, but for want of presence of mind and the proper precaution the execution was awkwardly enforced.

Nothwithstanding the advantage that instantaneous death can be effected by electricity, it should not be used for that purpose, and for the following reasons:

First. The process is connected with too much excitement and expense.

Second. It is not as practicable an agent to handle as the rope, the guillotine, or the gun.

Third. It is an agent that only professional electricians should handle, and where is the one that would prove executioner for a fee?

But we, too, have our objections to hanging and the use of the guillotine, not so much in sympathy for the criminal, as for the innocent and helpless executioner.

All processes of inflicting death on criminals are revolting, and have a tendency to arouse our deepest sympathy—at least until we get used to it. But has a murderer really any claim to our sympathy; has he even a right to live? Let cool judgment and stern justice be brought to bear on his case, and he should be punished by death; but why not have it done without having his blood on the mind and conscience of the executioner?

Rome and Greece, in the zenith of their intelligence and political power, managed these executions with a refinement that even the present enlightened age could not improve upon. And that was to inflict a merciful death, without doing violence to the feelings of an active executioner. The criminal was ordered to take poison with his own hands, and often one of his own choice; and that was the beginning and the end of the whole affair.

But in inflicting death in this way in this age, what an immense advantage we have over the ancients. They had no chloroform, where a sweet dreamy sleep ends in death; no prussic acid, that would kill quicker than electricity killed Kemmler.

The question may be asked: Is the administration of poison to effect death as practicable as any other method of execution? History would answer this in the affirmative.

Let us cite a case, say a murderer, who cuts his wife's throat in a fit of jealousy, a kind of murder of almost daily occurrence. The man is sentenced to death.

Where are his claims to our sympathy, even to give him a death less merciful than the one he gave his unfortunate wife. But if our feelings are too tender to see him hung, beheaded, shot, or knocked out of existence by an artificial thunderbolt, then when the time of execution is on hand, let the jailor place a bottle of chloroform or prussic acid before him, with instructions to take the execution in his own hands, with the understanding if he deos not meet the demands of the laws, he is to be hung, or otherwise executed with a violent death. We may have no fears but almost in every case the Roman penalty would be accepted.

Perhaps there is no influence that fosters a disposition to murder more than this morbid sympathy of the masses. The Kemmler excitement will end in much harm. In Texas we have about 800 murders committed yearly. Under this mischievous sympathy we hardly ever find a jury that has the manhood and the courage to pass the sentence of death on a criminal, that may have murdered one of his fellow beings in the most shocking manner. They not only turn loose a dangerous man on society, but he may afterwards be lionized for the very crime he committed. To show to what a dangerous extent this is carried out, I have only to refer to the city of Austin. Several years ago there was a ruffian that was the terror of the place, after killing about a dozen men. It appears from the fact that he had such a formidable record he was elected by the people as marshal of the city. And it is said he made a very good marshal, for every rough knew how to respect him. In the same town a violent, disagreeable man murdered a harmless German in cold blood; of course, after some time, he was acquitted. Yet this very murderer afterwards was elected Mayor of the city. These are some of the effects of sympathizing for the murderer, and it is a question of the greatest importance how to remedy the evil.

I know only one way, and that is for Congress to make murder a national offence, and let those cases be rigidly disposed of by the United States Court. Let it be known that it is dangerous to kill a citizen of the United States. If the general government protects us in our suffrage, serves us with legal money, with constitutional laws, etc., why not protect our lives, which are dearer and more sacred to us than all the rest put together? But to effect such a revolution requires brave and great men in Congress.

Deaths from Illuminating Gas.

Edward Y. Parsons, a young man 29 years of age, was killed by illuminating gas on Sunday night at his residence, 36 West Seventeenth street. Mr. Parsons has worked in a music store in Union Square for the past eight years. Deputy Coroner Jenkins, who has much experience in such deaths, after investigation, concluded that death was due to accidental causes.

From a variety of causes, deaths from the fumes of illuminating gas are more common in this city than they should be. The belief that it is only some luckless hayseed who blows out the gas, is confronted with such cases as young Parsons, who was to all intents and purposes a New Yorker. Most of the strangers, too, who meet with accidental death in Bowery lodging houses from the fumes of illuminating gas must be familiar with its use. Still, omitting suicides, there is at least one death each month from this cause.

Death from illuminating gas is much rarer in Philadelphia than in this city, and is almost unknown in the large cities of Europe. The enormous cost of real estate in this city means the economy of room space in the more crowded parts of Manhattan Island. In most of the newly built houses, and in a majority of those built some years ago, open fire places are unknown. Thus the ordinary bedroom is without the cheapest and most efficient ventilating shaft the wit of man has ever devised.

Yet the absence of chimneys in bedrooms does not account sufficiently for all the accidental deaths that result from the escape of illuminating gas in New York city. It seems probable that some part of the mischief must lie in the quality of the gas itself. Illuminating gas made from bituminous coal alone, passed through quicklime and properly scoured in water towers, is practically an inert poison; it causes suffocation by displacing the oxygen of the air. Gas prepared in this way is also lighter than air, and an open window ought to be a perfect antidote against any fatal results from its escape in a bedroom.

From the number of deaths that result from illuminating gas in this city, it seems likely that small quantities of some such active poisons as carbonic oxide or acetylene may be mixed with the illuminating gas. It might be well for the Health Board to make an analysis of our ordinary illuminating gas on these lines.—*New York Evening Sun.*

The Electric Light Car of the Pennsylvania Railroad Company.

We are indebted to our esteemed contemporary, *Engineering News*, for the diagrams of the electric light car, which is used for the novel purpose of providing ample illumination at short notice at any point where a temporary need therefor arises, either at a wreck or washout, or new piece of construction, or about yards or shops. It has been in very satisfactory use for about two years on the progressive Pennsylvania R. R., and the drawings are so clear as to need little further comment or description. Racks for 10 arc lights are provided, and the power is ample for running that number, or even two or three more lamps.

The boiler, which is only shown in outline, is of the upright tubular type, containing 160 1½-inch tubes 2 ft. 3½ inches at the center and slightly longer at the sides, the top flue sheet being dishing. The entire length of sheet, which includes the fire-box, is 6 ft. 9⅝ inches, and the outside diameter, 3 ft. 4 inches. The stack is 11¾ inches interior diameter at the throat. The lamp tripods are 25 ft. high, of the simple form shown in the illustration, and are carried in racks on top of the car, as shown. The car is supplied with a complete list of miscellaneous electrical supplies, and is thus prepared to quickly furnish almost any desired amount of light.

FIG. 3.—TRIPOD FOR ARC LIGHT.

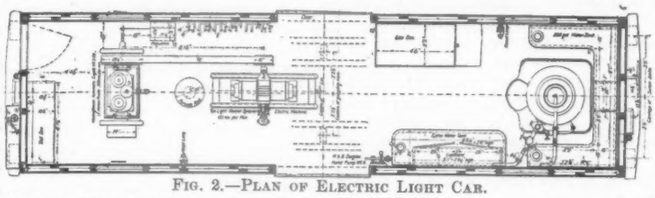


FIG. 2.—PLAN OF ELECTRIC LIGHT CAR.

Underground Work in Washington.

Under a new interpretation of the law relating to the construction of electric wires in Washington, D. C., the local lighting company and the Chesapeake & Potomac Telephone Company have been granted permits for quite extensive underground work. Heretofore it has been held that the law permitted nothing more than the taking down of overhead lines and placing them underground along the same streets. The new ruling allows the laying of underground conduits equal in mileage to the overhead lines removed, without regard to their respective locations. Another concession is in favor of pole lines running through alleys which are now allowed to cross streets and form continuous lines through the city. These privileges belong specifically to companies now doing business, but certain newly organized companies claim that they are not debarred from constructing lines and are preparing to test the question. The lighting company is preparing to introduce the Thomson-Houston alternating system to supply incandescent lights to customers more than one mile from the central station. The Edison direct system will be continued for service near the station. The price for public arc lights has been fixed at last year's rates—60 cents per light of not less than 1,000 actual candle-power, burning from sunset to sunrise, and not more than 40 cents for such lights if operated by overhead wires.

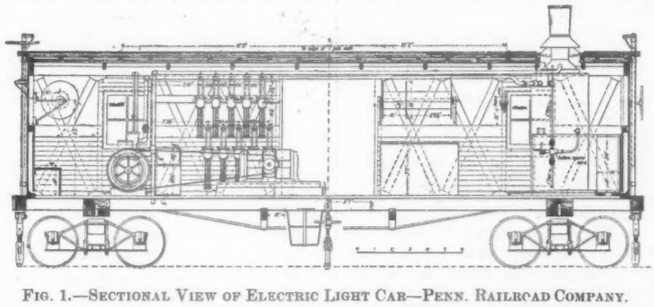


FIG. 1.—SECTIONAL VIEW OF ELECTRIC LIGHT CAR—PENN. RAILROAD COMPANY.

AN INTERESTING COLUMN.

Accustomed to It.

"You say you were buried alive, once?"

"That's what I said."

"You must have felt queer."

"Oh, no; I was used to it."

"Used to it?"

"Yes; I was salesman for a year in a house that never advertised."

A Popular Rendezvous.

During a recent thunderstorm in Paris, three flashes of lightning are said to have reached the top of the conductor of the Eiffel tower simultaneously, resulting in a remarkable display and considerable vibration on the part of the big iron frame, but no apparent damage was done.

Retirement of the Gray Mule.

The electric cars have taken charge of the streets from headquarters to the Fair Grounds, and they will astonish the natives. The circuit is complete, and the double trolley runs like clock-work. Two cars attached went up Broadway like skyrockets. There is no doubt in the world but what the crowds will be accommodated by the force of electricity to and from the Fair Grounds.—*Lexington, Ky., Transcript.*

Fixtures Damaged.

Early in the morning of August 27th, fire was discovered in the building, 525-529 West 34th street, occupied by the Bergman Electric and Gas Fixture Company and the Interior Conduit and Insulation Company. The firemen after an hour's hard work succeeded in confining the fire to the basement of the rear extension, where it is supposed to have originated. The cause is unknown. The loss to both companies is estimated at $25,000.

You Touch the Base, Electricity does the Rest.

A veteran base-ball player, who is now on the Pacific coast, writes as follows concerning an electrical device which is to be introduced into the game: "In our game yesterday we tried the new first base bag. It is made of rubber, with an electrical attachment, and the minute the fielder or runner touches it, a bell rings in the grand stand. It is hoped that this arrangement will assist the scorer or reporter in deciding whether the umpire's decisions on close plays are correct, but, to my mind, there is nothing that can be invented that will be an improvement on the old canvas bag."

An Important New Construction Company.

The National Electric Construction Company, incorporated under the laws of Maine, has recently opened its offices at 620 Atlantic avenue, Boston, Mass. The capital stock of the company is $2,000,000. The following named gentlemen are the officers of the company: Gen. Benj. F. Butler, president; A. H. Sawtell, vice-president and general manager; Hon. Lynus N. Child, treasurer; T. Henry Pearse; Dr. Allan V. Garratt, general manager of the electrical and engineering departments.

Mr. F. Z. Maguire, of 18 Wall street, New York, is the financial agent, and is handling the securities of the company.

Electrical Indicator of Explosive Gases.

An apparatus which indicates with safety the accumulation of explosive gases in the atmosphere of rooms is of great importance in many trades, and especially for use in mining operations and in the transport of coal by ships. M. Eduard Stern, of Cologne, has brought out such an apparatus, says our London namesake. It consists of an external porous clay cylinder which contains a thin metal membrane capable of upward movement. Just above the membrane is a contact screw. When explosive gases begin to accumulate, they pass through the porous cylinder and gradually raise the membrane until it comes into contact with the screw. This completes an electric circuit and sets in operation a set of electric bells. The contact screw is very sensitive and may be adjusted to any degree, according to local circumstances. The apparatus is also applicable as a fire alarm and may be fitted in any convenient spot.

KINDRED INTERESTS

The Perkins Electric Lamp Company have removed their executive offices from Hartford to their factory at Manchester, Conn.

The Western Electric Company's latest catalogue is a handsomely gotten up pamphlet in a green and gold cover. All their more important productions are well illustrated.

Alfred F. Moore, Philadelphia, has sent us a very handsome catalogue of his insulated wires. The cuts are printed in colors, and the list of wires for every electrical purpose is most complete. It is a beautiful and tasty pamphlet.

The Edison-Lelande Battery is fully illustrated and described in a beautifully gotten up pamphlet issued by James F. Kelly, 19 Dey street, New York, the general sales agent. The testimonials as to the efficiency of this battery are strong and convincing.

The National Carbon Company, Cleveland, Ohio, is out with its annual directory of "Arc Lighting Plants in North America." There are 25 pages more in the present issue than in last year's, which fact gives ample evidence of the rapid increase in electric lighting interests in this country.

The Fort Wayne Electric Company, Fort Wayne, Ind., has sent us a list of plants equipped with the Wood system of arc lighting, which it sold during the interval between October 1, 1889, and August 1, 1890. The list embraces 46 installations, with a total of 9,775 lights, averaging a little over 212 lights to each plant.

The Short Electric Railway Company is building tracks throughout the streets around their factory at Cleveland, Ohio, connecting their various shops and shipping departments, and are arranging to haul all their materials and supplies from one place to another by means of flat cars equipped with electric motors.

The United Electric Traction Company, 115 Broadway, New York, has sold to the Citizen's Street Railway Company, of Indianapolis, Ind., several storage battery cars complete, the terms being cash on receipt of the bill of lading. This is probably the first sale of storage battery cars on such terms in this country.

Messrs. C. & G. Cooper & Company, of Mt. Vernon, Ohio, are engaged in putting up Corliss engines of their manufacture as follows: At Florence, Ala., cotton mill, one of 800 horse-power; at Dennison, Texas, cotton mill, one of 800 horse-power; at Knoxville, Tenn., electric light station, one of 450 horse-power; at Rochester, N. Y., electric light station, one of 450 horse-power; at Spartanburg, S. C., cotton mill, one of 1,200 horse-power.

The Great Western Electric Supply Company, Chicago, have gotten in a large invoice of telegraph apparatus, and their learner's outfits are already being rapidly disposed of. They have several other large lots on the way, and expect to control a good part of the Western business in telegraph apparatus. The company is also selling large quantities of the Samson batteries, which have heretofore been better known in the East than in the West. A new catalogue will be issued this week.

The Standard Underground Cable Company, Pittsburgh, will erect a rolling mill in connection with its new plant at Brinton for the rolling of brass, and a copper wire mill with which all the copper wire used by the company will be made. The copper used will come from the mines and smelting furnaces in Montana, where the late Professor Ashburner made a discovery of valuable deposits of copper. Several thousand acres of land were purchased by a company formed, in which George Westinghouse was a leading spirit, the idea being to produce all the copper used in his various industries.

The popularity of the great Pennsylvania Railroad route to the West is largely due to the well-known equipment of that road in all the appliances which ensure the safety of the passenger. The block-signal and interlocking switch system, stone-ballasted roadbed, and stone bridges, make a safe highway for the great procession of trains that line its tracks daily. The Pennsylvania Limited is the leader of not only these, but all passenger trains of the world. It leaves New York daily for the West at 10 A. M.

The John Stephenson Company, New York, is a hustling firm when it comes to getting out street cars in a hurry. They recently received the following letter:

EDISON GENERAL ELECTRIC COMPANY.
NEW YORK, August 25, 1890.

JOHN STEPHENSON COMPANY, LIMITED.

Dear Sir:

Mr. Vail has referred to us your favor of the 23d inst. and we write with pleasure that the cars for the Elmira road have all been shipped in good order.

I desire to express my appreciation of your promptness in this matter.

Yours truly,
(Signed) CHAS. D. SHAW,
District Manager Eastern District.

The order for these six cars was booked by "John Stephenson Company, Limited," the evening of Wednesday, July 30. The material was taken from the stockroom, the cars were constructed and completely finished, motors all attached, wiring done, trolley bridge in place, and they were shipped, in perfect order, for electric service, August 21, 22, 23, respectively—two cars each day. August 25, Col. D. C. Robinson, president of the railroad company, announced by telegram the arrival of the cars at Elmira in good order.

F. Z. MAGUIRE,
ELECTRICAL SECURITIES, ETC.,
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Washington Electric Conduit Co.,
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TESTIMONIAL.

OFFICE OF
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OFFICE AND STATION,
Nos. 48 and 50 CHESTNUT STREET,
BRADFORD, Pa., Aug. 6th, 1890.

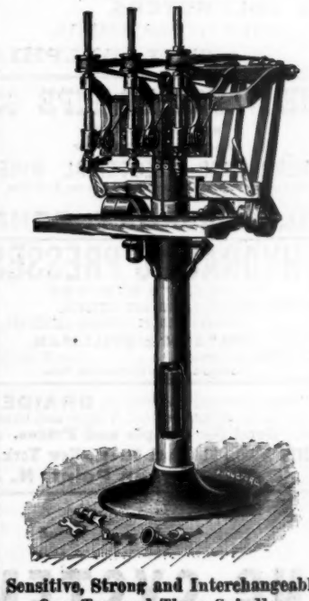
CHAS. A. SCHIEREN & Co.,
Nos. 45-51 Ferry Street,
New York City.

DEAR SIRS:

Will say in reply to yours of July 28th, that we have three of your 10 inch Perforated Belts running alongside of solid ones with far better results. They are easier on bearings, use less oil and are noiseless. As fast as I can, will replace the solid belts with perforated.

Very truly yours,
J. H. ROSS,
Sec'y and Gen'l Manager.

Sigourney Drills.
IMPROVED.



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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON AUGUST 19, 1890.

(*Continued from last Issue.*)

434,457 Electrode for batteries and the method of making the same; David Pepper, Jr., Philadelphia, Pa.

434,468 Method of electric welding; Russell Robb, Boston, Mass., assignor to the Thomson Electric Welding Co., of Maine.

434,488 Electric power transmission. 434,489 Electric power system; Elihu Thomson, Lynn, Mass.

434,501 Electric meter; Jules Canderay, Paris, France.

434,530 Process of and apparatus for forming and welding metals by electricity. 434,531 Induction-discharge protector for welding apparatus. 434,532 Process of electric welding; Elihu Thomson, Lynn, Mass., assignor to the Electric Welding Co., of Maine.

434,557 Voltor ampere meter. 434,558 Device for measuring the intensity of magnetic currents; Rudolf Eickemeyer, Yonkers, N. Y.

434,579 434,863 434,580 434,581 Apparatus for transferring electric car batteries. 434,582 Mechanism for transferring electric car batteries; Frederick G. Corning, New York, N. Y.

434,585 Telegraph-relay; Thomas A. Edison, Menlo Park, N. J.

434,586 Electric generator. 434,587 Thermo-electric battery. 434,589 Propelling mechanism for electric vehicles; Thomas A. Edison, Llewellyn Park, N. J.

434,588 Magnetic ore separator; Thomas A. Edison, Llewellyn Park, N. J., and Wm. K. L. Dickson, Orange, N. J.

434,590 Dynamo electric machine; Justus B. Entz, New York, N. Y., assignor to Thomas A. Edison, Llewellyn Park, N. J.

434,593 Galvanic battery; Wm. M. Fink, Elizabeth, assignor of two-thirds to Sherman Cooper and Philip Hathaway, both of Westfield, N. J.

434,596 Electric push-button; Philip Hathaway, New York, N. Y.

434,614 System of electrical distribution; Henry E. Walter, Schenectady, N. Y.

434,639 Tower for electric lighting; David Maxwell, Detroit, Mich.

434,640 Thermal battery; Hugo Mestern, Munich, Germany.

434,671 Electric valve-closer; Lemuel Mellett, Boston, Mass., assignor to himself, A. D. Tingley, A. L. Russell and A. P. Lighthill, all of same place.

434,682 Trolley for electrically propelled cars; Wm. L. Stevens and Edwin J. Wescott, Boston, Mass.

434,684 Electric railway system. 434,685 Alternate current electric railway train system. 434,686 Electric railway train system. 434,687 Electric railway system. 434,816 Multiple circuit electric motor; Charles J. Van Depoele, Lynn, Mass.

434,746 Electric belt and appliances; Robert E. Williams, Dallas, Tex., assignor of one-half to Wilbur F. Shook, same place.

434,774 Thermometer; Edwin M. Fox, Brooklyn, assignor to Philip Hathaway, New York, N. Y.

434,827 Electric railway; Adelos Gorton, Camden, N. J.

434,835 Portable electric signalling device; Peter Pearson, New York, N. Y.

434,853 Contact box; Ferdinand A. Wessel, Brooklyn, assignor to the Excelsior Electric Company, New York, N. Y.

434,869 Secondary battery plate; William B. Hollingshead, Brownsville, assignor of one-half to Sydney H. Carney, New York, N. Y.

434,871 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor to the Electric Car Co. of America, same place.

434,879 Electric insulators; Samuel Oakman, Melrose, Mass.

434,880 Recording telegraph. 434,881 Printing telegraph; John B. Odell, Chicago, Ill., assignor to the Printing Telegraph Co. of Illinois, same place.

434,885 Electric conductor; William A. Phillips, Schenectady, N. Y., assignor to the Edison Machine Works, same place.

434,892 Binding post; Gordon J. Scott, Schenectady, N. Y.

434,899 Electric switch; Charles E. Wilson, Chicago, Ill.

PARTIAL LIST, ISSUED AUGUST 26.

434,917 Hanger for incandescent lamps; Paul J. Chassagne, Akron, Ohio, assignor of five-eighths to Samuel Miller and Wm. R. Palmer, same place.

434,943 Electric connector; Edward L. Orcutt, Somerville, Mass.

434,949 Gearing for electrically-propelling vehicles; Nathan S. Possons, Cleveland, Ohio.

434,961 Section insulator for overhead electric conductors; Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.

434,992 Insulator; Chas. O. Muehlberg, Pittsburgh, assignor of one-half to Henry Staunn, Mt. Oliver, Pa.

434,993 Motor for street cars; Wm. H. Patton, Chicago, Ill., assignor to the Patton Motor Co., Pueblo, Col.

435,011 Trolley for electro-motor cars; Samuel D. Cairns, Troy, N. Y., assignor of three-fourths to Dennis J. Whelan, Wm. J. Roche and James T. Quinn, all of same place.

435,015 Dynamo electric machine; Wm. F. Collins, New York, N. Y., assignor of one-fourth to Wm. A. Rosenbaum, Jersey City, N. J.

435,034 Incandescent lamp socket; Frederick C. Rockwell, Hartford, Conn.

435,029 Cut-out for electric lamps. 435,030 High resistance shunt compound; Wm. G. Bremer, St. Louis, Mo., assignor to the United Electric Improvement Co., Gloucester City, N. J.

435,066 Method of and means for bending electrotype plates; Patrick M. Furlong, New York, N. Y., assignor to the Curved Electrotype Plate Co., of New York.

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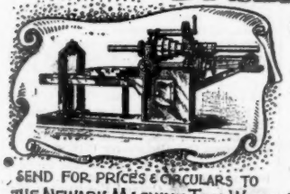

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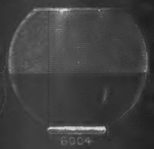

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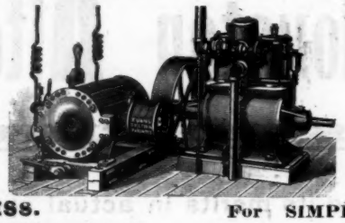

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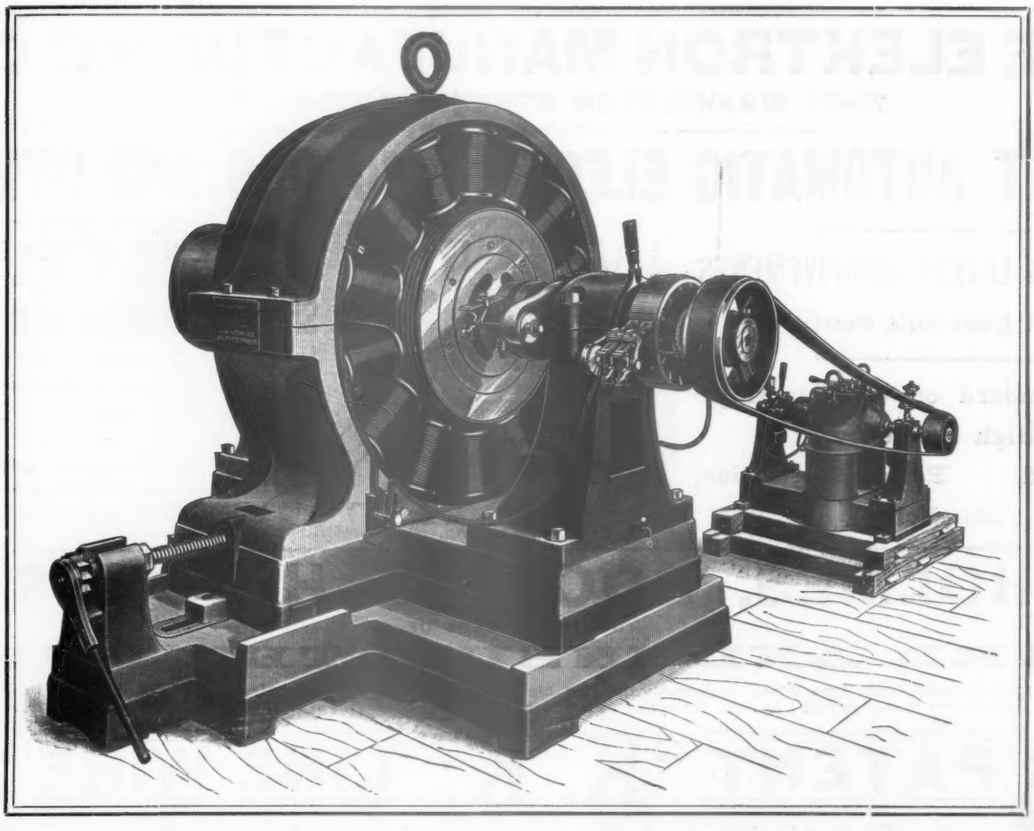

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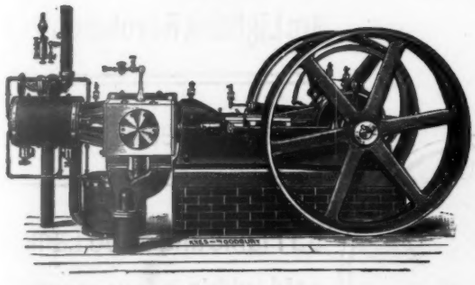

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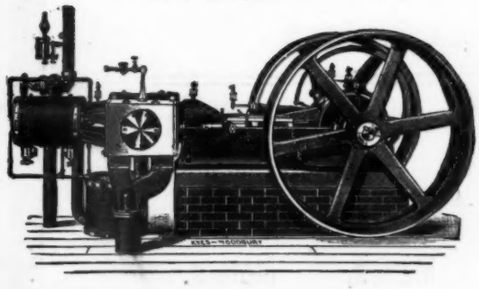

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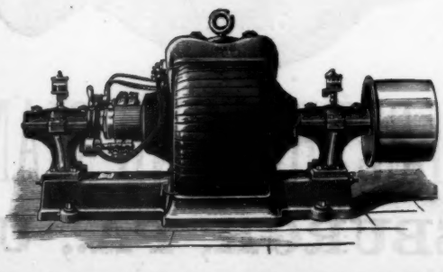

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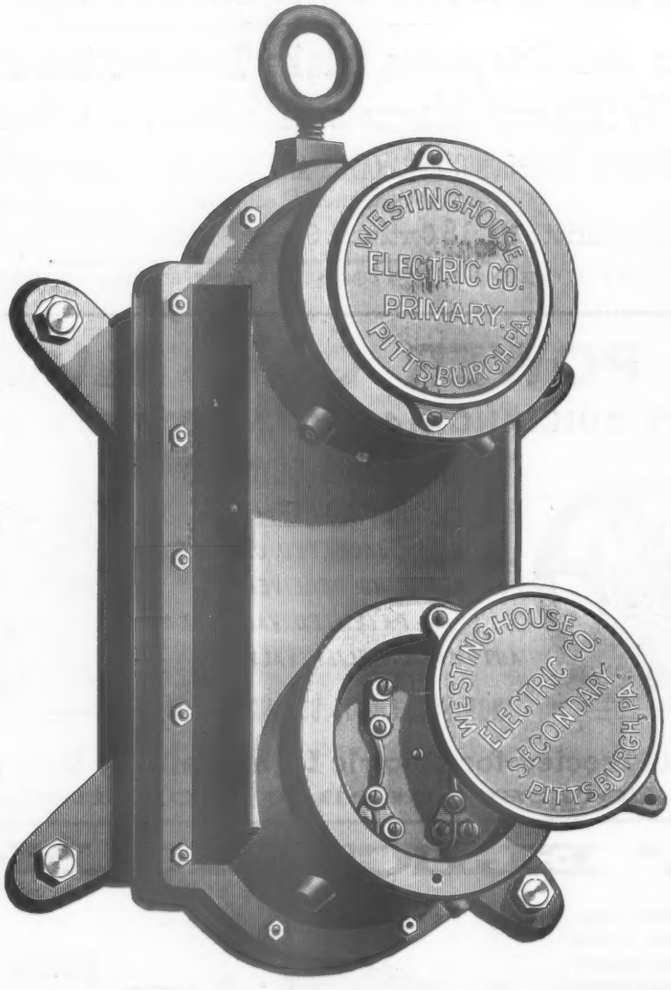

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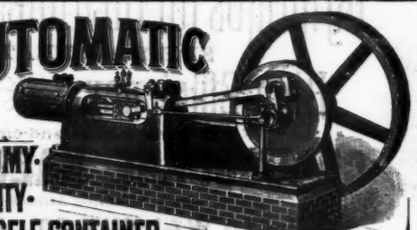

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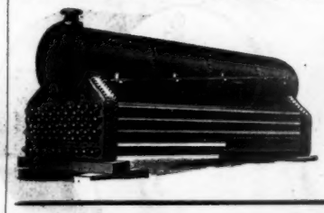

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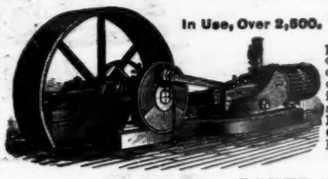

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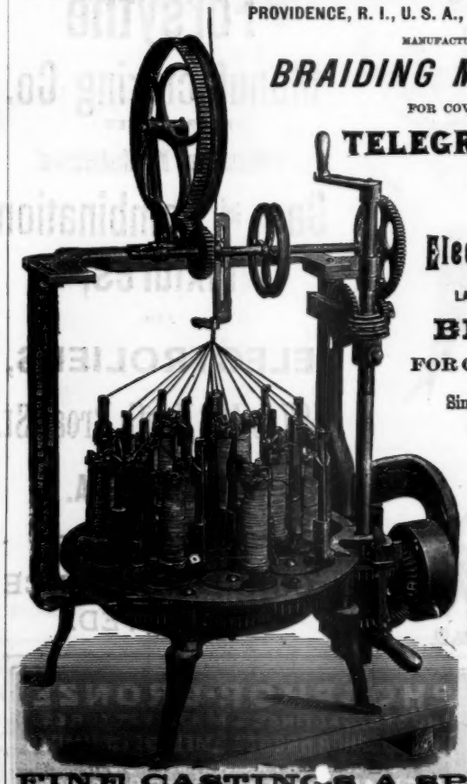

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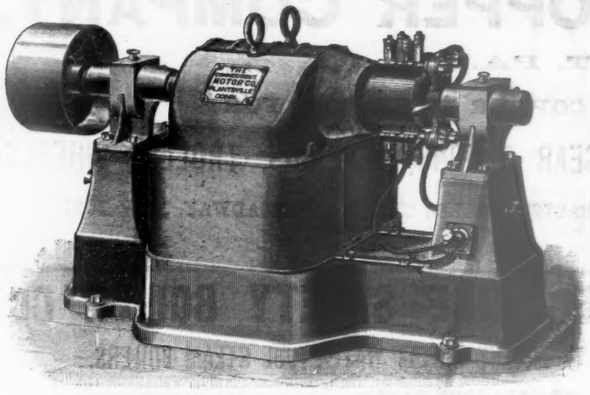

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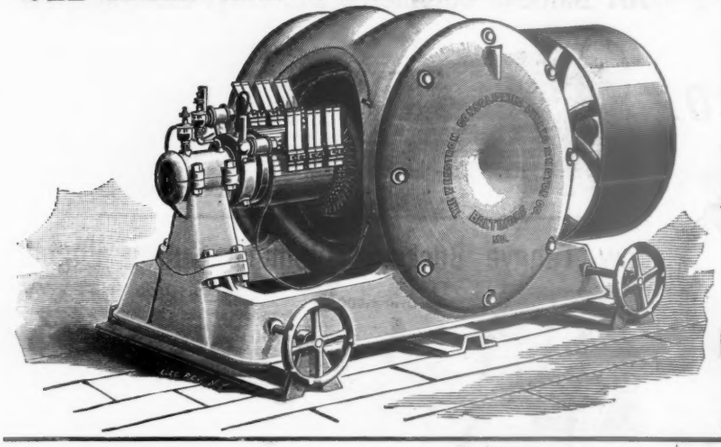

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C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2½		780
F	30	.....	.....	.....	15.0	3		900
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G	.....	.....	45	.....	21.0	4		1,360
H	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
J	52	.....	.....	.....	38.0	8		2,260
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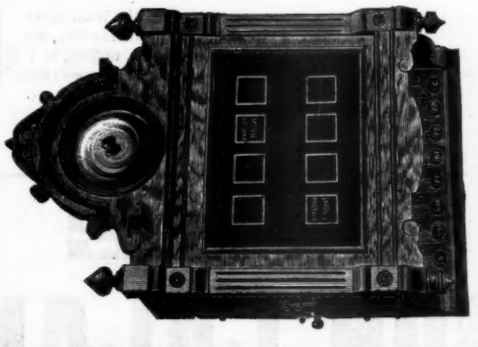

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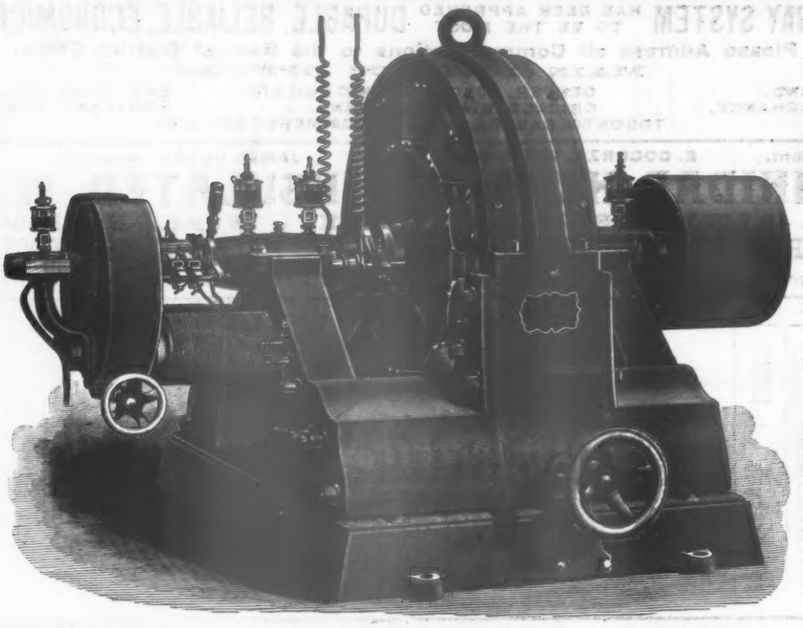

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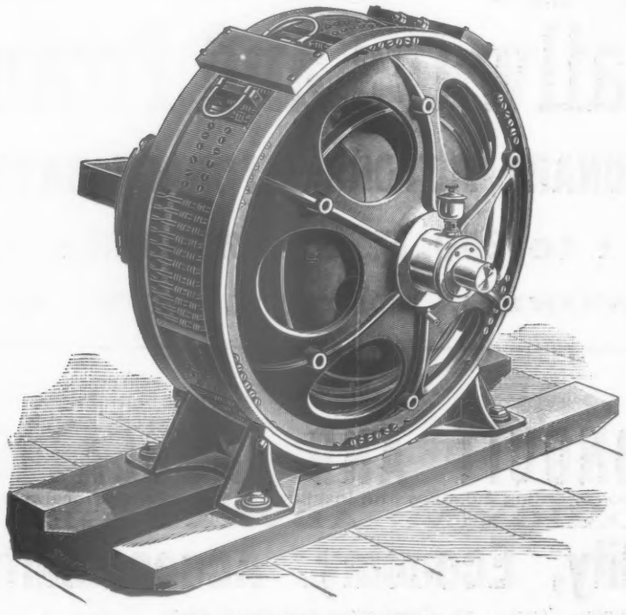

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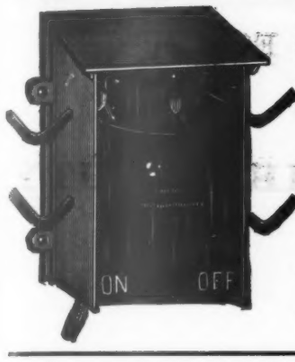

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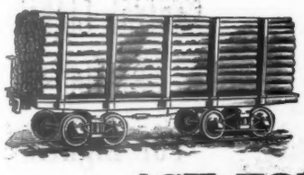
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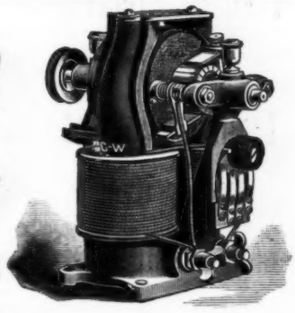

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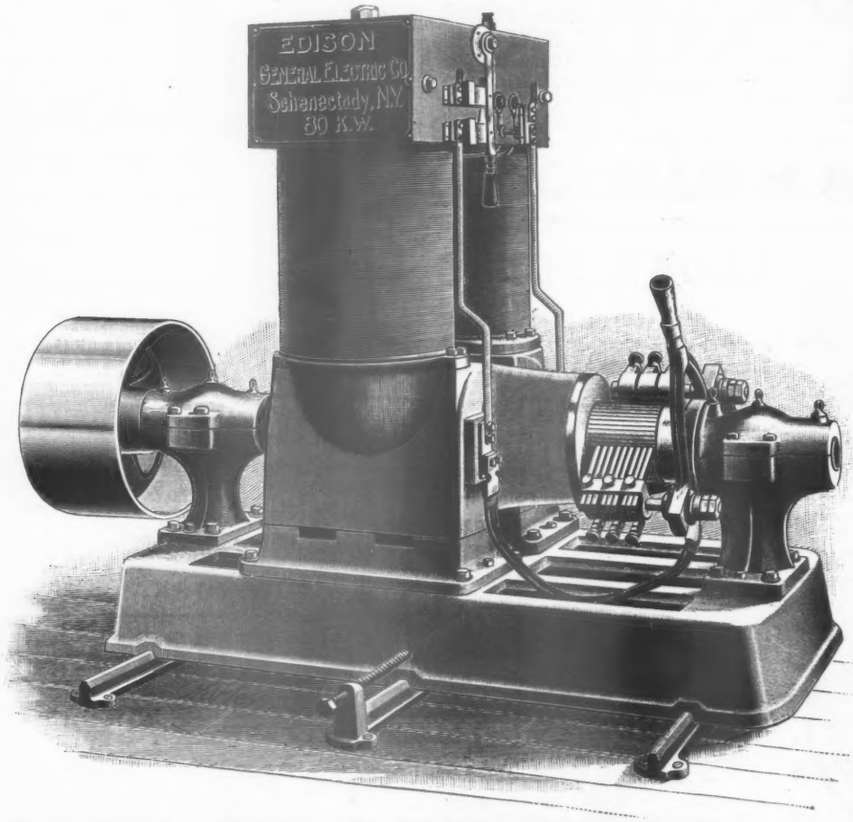

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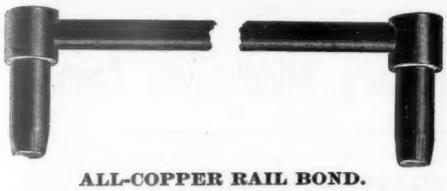

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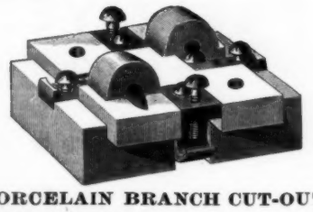

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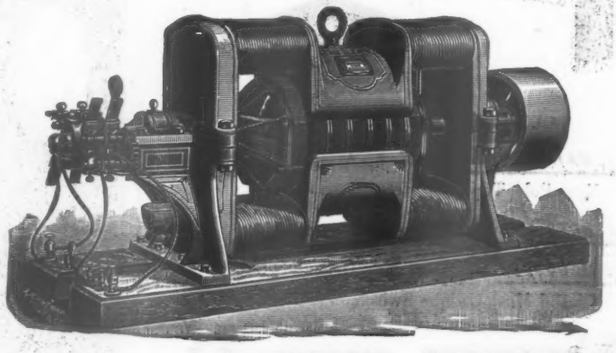

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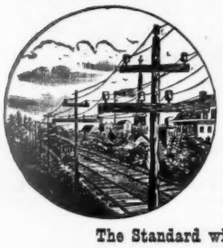

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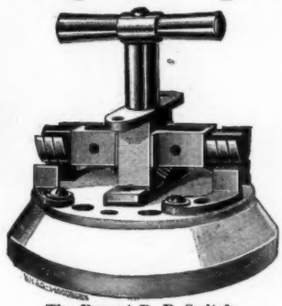

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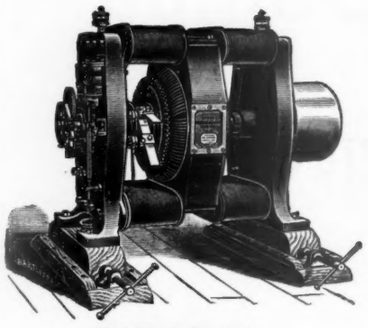

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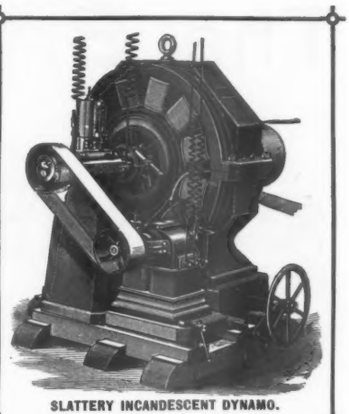

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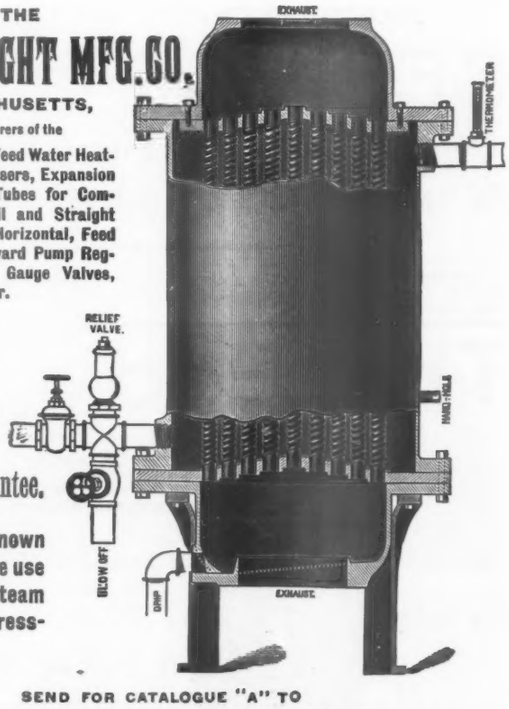

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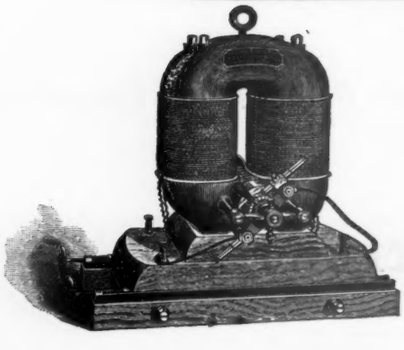

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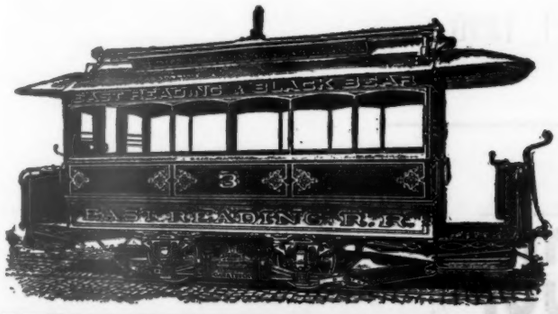

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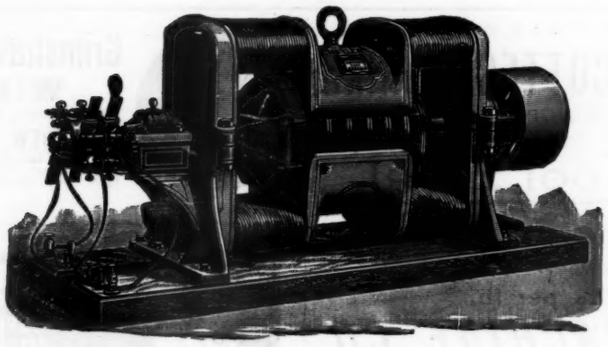

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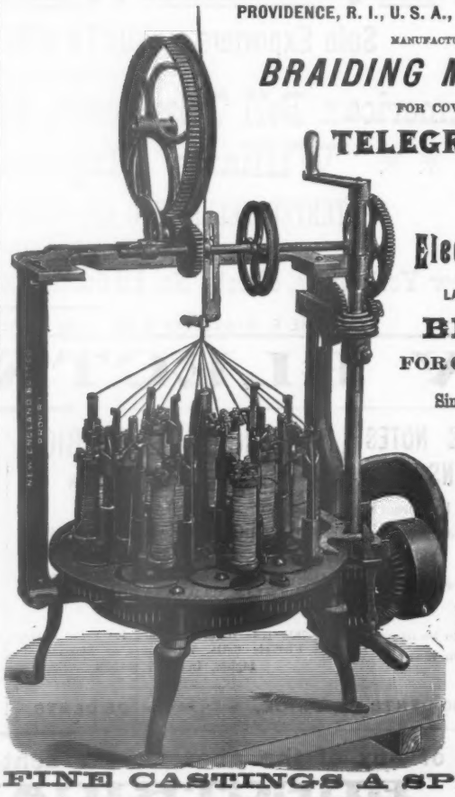

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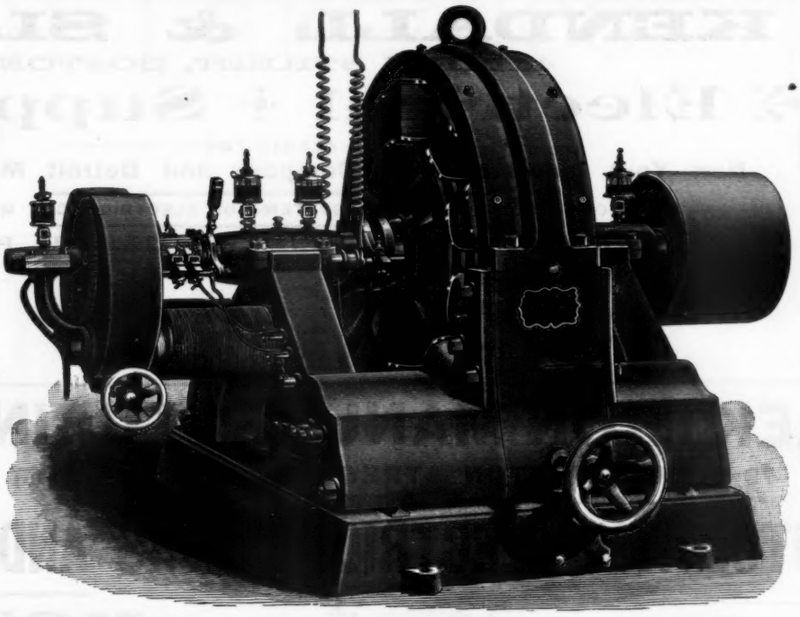

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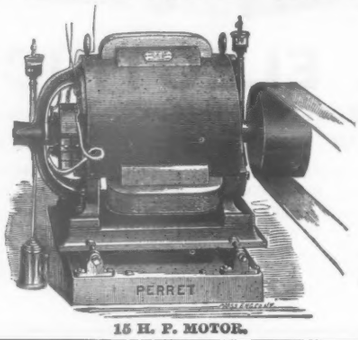

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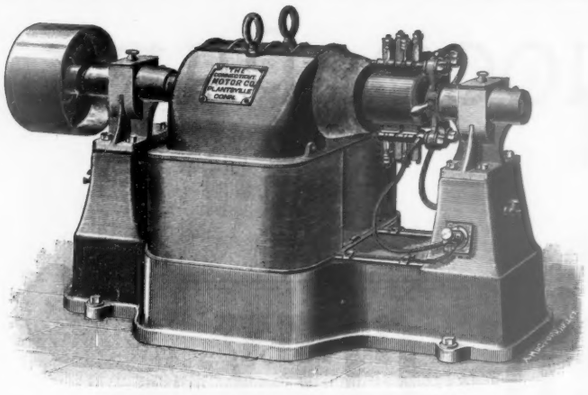

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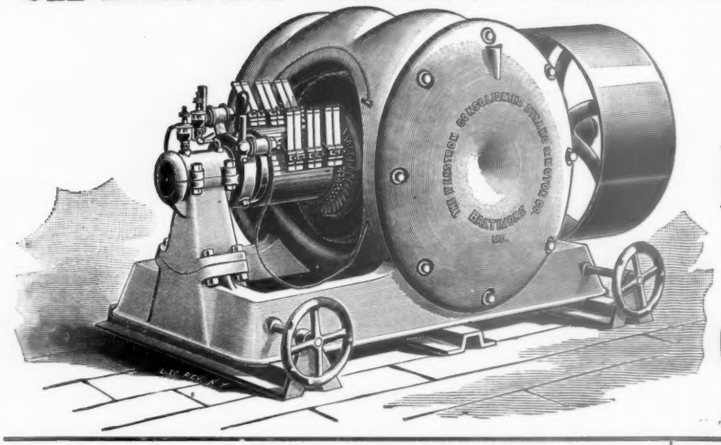

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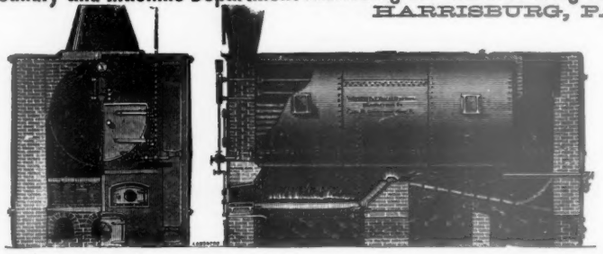

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